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# ***JPRS Report***

# **Science & Technology**

***Europe***

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# Science & Technology Europe

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18 February 1992

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## ADVANCED MATERIALS

### Swiss Ciba-Geigy Develops Improved Resin for 3D Lithography

92WS0185C Paris INDUSTRIES ET TECHNIQUES  
in French 15 Nov 91 p 84

[Article by Mirel Scherer: "A New Resin for Stereolithography"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Ciba-Geigy's new resin is much less fragile than previous ones. The dimensional precision of the models produced is growing.

Stereolithography is expunging the "sins" of its youth. The process quickly manufactures models and prototypes by irradiating a light-sensitive resin with an ultraviolet laser that is directly controlled by a computer-aided design system, polymerizing the resin. The first generations of the machines have been operating since 1988 with a resin that has a high elasticity modulus but little elongation at tear. As a result, the pieces using the process were fragile and not very precise (to several tenths of a millimeter).

#### Impact Resistance Multiplied by 16

Despite its rapidity, the process cannot measure up to the results obtained with manual machining or control computers, even for very complex pieces. This explains the hesitation of industrial users to employ the new technology. Not to be deterred, 3D Systems—a subsidiary of the Swiss chemicals group Ciba-Geigy—has just announced the development of a new resin. The company has 300 stereolithography machines installed worldwide, in highly diverse industrial sectors. The XB5143 resin (1,200 French francs [Fr] a kilo) was created in its research laboratories and eliminates the deficiencies of the resins used before now. Although slightly softer than the previous resin (Shore 75 instead of 90), its impact resistance has been increased by 16 (from 2.5 to 40 kJ/square meter). Its elongation at tear has also been improved: from 3 percent to over 20 percent.

These developments mean that the pieces produced will be able to be machined or tested in wind tunnels and under real-life conditions. Using the resin, which is undergoing testing in the United States, will be all the more effective because the manufacturer is also announcing the availability of a new control software program.

Christened Weave, the program produces a substantial gain in precision (less than 5  $\mu$ m of contraction heterogeneity per millimeter), in speed of manufacture (30 hours compared to 70 a year ago), and in the surface condition of the pieces. The next resins, which Ciba-Geigy is now developing, will be adapted for different industries and will further improve mechanical and physical characteristics.

### Germany: Ceramic Membranes Developed for Chemical Separation Processes

92WS0188B Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 26 Nov 91 p 8

[Text] Essen—Compared to conventional synthetic membranes, ceramic membranes are much more resistant to chemicals and high temperatures. However, their production is still encumbered by significant problems. Nevertheless, numerous research groups around the world are involved in intensive efforts to develop in particular thin ceramic films without holes or tears in reproducible quality.

At the Institute for Technical Chemistry of the Polytechnical University of Essen, scientists have recently produced homogeneous ceramic films based on silicon dioxide. In this process, silicon dioxide is evaporated with electron beams and precipitated on ordinary aluminum foil as a microporous film, according to the ZEITSCHRIFT ANGEWANDTE CHEMIE (Vol 103, p 1523).

From this substrate, the film can then be gently removed using water or hydrochloric acid. The film can be of almost any thickness, depending on the reaction time of the electron beam. Thus far, ceramic films with thicknesses ranging from 250 to 4,000 nanometers have been produced. The film grows in thickness at a precipitation rate of between two and 20 nanometers per minute.

While the separation efficiency of a polymer membrane is based on various solution properties of the synthetic matrix, ceramic membranes separate a mixture of substances depending on the size of the molecules. Accordingly, they act as a molecular sieve, and in their effect they resemble zeolites, which are also formally constructed from a silicon dioxide sublattice. Indeed, numerous working groups are attempting to produce thin ceramic films based on zeolites.

In this process, however, the microcrystalline structure of this class of compound has proven to be a significant obstacle. In contrast, the researchers in Essen are focusing on an amorphous silicon dioxide, which is apparently better-suited to the synthesis of thin, uniformly constructed ceramic films. The working group associated with Wilhelm F. Maier had used similar silicon dioxide films several years ago in heterogeneous catalysis. At the time, the ceramic oxide layer (precipitated on a platinum-coated silicon wafer) was supposed to prevent direct contact between the organic reagents and the noble metal.

Only the hydrogen needed for hydrogenation made it to the platinum layer and was activated there. It was initially unclear how the gas could penetrate the ceramic layer. At the time, the Essen researchers were unable to present any proof of the obvious assumption that microfine pores and channels permitted this transport process.

Since then, it has been possible to produce a detailed explanation of the pore structure. In studies on the adsorption of nitrogen with films of 10 different thicknesses, the Essen researchers continually came up with the same pore volume of 0.05 to 0.09 cubic centimeters per gram of ceramics. Accordingly, the adsorbed nitrogen molecules are not stopped by the external roughness of the material, but rather are incorporated into the pores and channels in the interior of the ceramic film.

The pore size itself is no greater than between 0.5 and 0.6 nanometers. In addition, the material features even smaller pores that cannot be occupied by nitrogen, but that can be occupied by hydrogen molecules. This distinctive pore structure should open up interesting applications for ceramic films made of silicon dioxide in separation processes in the food industry, in gas separation, or as a component of microelectronic sensors.

In some of these areas of application, they could also possibly compete with zeolites. However, there have not yet been any studies into whether the necessary different pore diameters can be effectively adjusted—e.g., through modifications during preparation of the films.

#### **France: Soficar, Toray to Expand Carbon Fiber Production**

92WS0257A Paris COMPOSITES ET NOUVEAUX MATERIAUX in French 18 Dec 91 pp 1,2

[Unsigned article: "Soficar Diversifies Its Carbon Fiber Line, Launches Second Production Unit at Pau"]

[Text] While the price of carbon fibers is dropping due to overproduction (8000 tons of fiber per year throughout the world, with the demand estimated at about 6500 tons), Soficar will start a second production line for Torayca fibers in mid-1992. Thus does Soficar expect to anticipate the demand of the new aerospace market created by Rafale. By diversifying its product line with this second production facility, the French government will be able to buy the material directly from a French company rather than a Japanese one.

It should be noted that the first carbon fiber production unit in France was the French government itself. As Claude Meschi, Soficar marketing, points out: "It was in the early 80's that the government decided to buy such a production unit; the world leaders were the Japanese followed by the Americans." In order to use the know-how and skills already gained by the foreign groups, collaborations were formed and two competing projects emerged: a French-Japanese association with Toray-Elf (Atochem), and the Pechiney-Hercules French-American association. The choice ultimately fell to the Toray-Elf (Atochem) association, which Pechiney then joined, to create the Soficar company in 1982.

During the first three years, the production unit located at Abidos, near Pau, produced 270 tons of carbon fiber, but the production was not fully sold. That is why

Pechiney withdrew. This led to a new commercial policy and an offering to European countries, and in 1989 the company posted a profit. Today, Toray has 70 percent of the shares, with Atochem holding 30 percent. This year, the predicted revenues are on the order of 300 million francs for a production of 350 tons.

#### **Double Production Capability and Expose New Markets**

With this new line, the company expects to rapidly double its production capabilities (700 tons), and especially to confront new markets, thanks to a diversification of its products. Two types of carbon fiber are currently produced at the Pau plant; four new types should be manufactured by mid-1992.

Intended for the design of composite materials, the Torayca carbon fibers have many properties sought in industrial sectors as diverse as sports, civilian aircraft, helicopters, space shuttles, competition boats, and even protection helmets. These fibers demonstrate great resistance to traction, fatigue, deformation, corrosion, and wear, they absorb vibration, conduct electricity, and are transparent to X-rays. The new production will thus supply M 40 J and M 46 J fibers intended for aeronautics, with the M 46 and T 800 H more specifically designed for sports, and to a lesser extent, for satellites.

#### **Toray Develops New Products for Soficar's Needs**

The Toray-Soficar partnership covers not only marketing, but research and development as well. In terms of sales, the Paris office supplies both Japanese and French fibers to the European market. Outside Europe, the two companies cooperate just as closely; even if commercial activities are less developed in Europe than in France, they are nevertheless quite decent in Germany and England, followed by Italy, Switzerland, Scandinavia, and Holland.

In research, "Soficar leaves the development of new products to Toray, which it is worth noting, announces a new carbon fiber every two years, sometimes even every year. Licenses are purchased depending on whether product is likely to be of interest on our markets. The Japanese also come here to learn our needs and develop appropriate products," indicates Meschi. Through this collaboration, Soficar takes advantage not only of a research facility, but also of technical assistance.

Direction Commerciale Soficar, 27 rue Nicolo 75016 Paris, Tel: (1) 45 03 47 47

## **AEROSPACE**

#### **Belgian Company to Provide Satellite Communications Systems**

92AN0110 Groot-Bijgaarden DE STANDAARD in Dutch 21 Nov 91 p 15

[Text] Antwerp—The telecommunications company Alcatel Bell, which last year supplied the local oscillators

for the French Telecom 2 satellite—a joint development with Toulouse-based Alcatel Espace, which was responsible for the entire satellite system—is now continuing this cooperation within the framework of contracts for the telecommunications satellites Intelsat VII and Turksat. Under these cooperation agreements, Bell will supply about 80 local oscillators.

Local oscillators are the core of a satellite communications system. They generate the frequencies required for the carrier waves to establish the actual communication.

Bell and Alcatel Espace are closely cooperating in other fields, too. Earlier this year, both companies carried out a joint study for the development of a new satellite control station, to be installed on the island of Kerguelen in the southern hemisphere. By now, Bell has already supplied the receiving equipment for further integration in Toulouse.

In cooperation with Aerospatiale, Alcatel Espace was also commissioned by Turksat—the Turkish national satellite program—with the development of the communications part and the ground control segment of the satellite system. Bell is also involved in this project. It has started the development of new receivers and measuring systems which will be incorporated in the ground control stations of this Turkish satellite.

Bell has already built several control stations throughout the world, in Sweden, France, Germany, French Guiana, and South Africa. The control station developed most recently was that of the ERS-1 [Earth Remote Sensing] satellite.

ERS-1 is an Earth observation satellite developed for the European Space Agency (ESA). The satellite allows, among other things, to trace icebergs on shipping routes, to measure wave heights in oceans, and to detect prevailing wind directions.

#### Norway Withdraws From Hermes Program

92WS0140D Paris LE MONDE in French 8 Nov 91  
p 16

[Unattributed article: "Norway Withdraws From Hermes Space Project"]

[Text] Norway, which financed 0.20 percent of the European Hermes space shuttle project, has just decided to withdraw from the project. The decision was made as European ministers were about to start negotiations on the future of the European space program, in Munich on 18-20 November. Hermes, a leading project in the long-term space program of the European Space Agency (ESA) is currently the subject of closely argued negotiations among ESA member states, as is the Columbus orbital laboratory project. In fact, technical constraints and budget rescheduling have appreciably increased the anticipated costs of these projects: +40.5 percent for

Hermes, which is estimated to cost Fr51.46 billion; and +14.2 percent for Columbus (1990 price: Fr35.61 billion).

#### Deutsche Aerospace, Carl Zeiss Create Joint Venture

92WS0147A Duesseldorf HANDELSBLATT in German  
13 Nov 91 p 25

["Deutsche Aerospace and Zeiss Found Joint Space Venture"]

[Text] HANDELSBLATT, Tuesday, 12 November 1991, JENA—Yesterday, the chief executive officer of Deutsche Aerospace AG (DASA), Juergen E. Schrempp, and his counterpart at Jenoptik Carl Zeiss Jena GmbH, Lothar Spaeth, signed a contract founding Jena-Optronik GmbH. Daimler-Benz Company's Luft und Raumfahrt holding is contributing 51 percent and Jenoptik 49 percent of the joint venture's original capital (5 million German marks [DM]). DASA will assume the management.

According to Spaeth, the joint venture offers the opportunity of taking advantage of the outstanding optical know-how of the Zeiss people. Initially, 80-100 scientists would be active in Jena-Optronik, by medium term Schrempp estimates the number will be between 180 and 200. The new company will be active in three areas: optical sensors and instruments (cameras, spectrometers) for air and space projects; orbital and satellite attitude measurement sensors; and sensor systems for earth observations. Schrempp estimates that medium term investments, including those for research and development, will amount to DM 30-50 million.

The DASA head announced that "some activities in the optics field are being shifted out of the old Federal Republic to Jena." Jena-Optronik is being linked operationally to the satellite and utilizations systems product sphere, which is now in the hands of DASA's affiliate in Friedrichshafen, Dornier GmbH.

Jena-Optronik is looking for a turnover of DM12 million for the coming year, which, for the most part, should come out of the budget of the Federal Republic's Ministry of Research. Both partners are keeping their eyes on the Soviet market. In that regard, Dornier has already received the first partial commission from the German Research Society for Air and Space for the development of a high-resolution stereocamera for a future Soviet Mars satellite. Dornier has given a figure of DM60 million for the total amount for the development and construction of this camera.

Jena-Optronik is DASA's third largest joint venture in the new German states. Previously, DASA-affiliate Deutsche Airbus GmbH, jointly with Flugzeugwerke Dresden GmbH, founded the Elbe Flugzeugwerke GmbH. And on 1 July 1991, another DASA affiliate, MTU Motoren und Turbinen Union GmbH took over Luftfahrttechnik Ludwigsfeld GmbH.

Cooperation with DASA means an important step in the direction of the concept "technology region Jena" for Jenoptik. And there is more to come. Spaeth has announced talks with other Daimler-Benz representatives. Sensor technology and traffic control planning will be the topics.

These joint ventures undertaken by Daimler Benz may well be a signal for other potential investors. The head of Jenoptik has already sensed "an increased interest" on the part of Japan. Since 7 November 1991 the negotiating partners have known exactly with whom they are dealing. On that day, the contract calling for the transfer of the core business from Jenoptik Carl Zeiss Jena GmbH to the newly founded Carl Zeiss Jena GmbH was signed.

### German Firms Divided on Value of Manned Space Flight

92WS0152A Stuttgart BILD DER WISSENSCHAFT  
in German Nov 91 pp 75-77

[Article by Wolfgang Hess: "The Non-Seller: A BILD DER WISSENSCHAFT Survey of the Biggest Industrial Companies"; first paragraph is BILD DER WISSENSCHAFT introduction]

[Text] According to the minister for research and technology, the Germans should make a greater commitment to manned space flight. But Riesenhuber's plans are encountering resistance even at many high-tech firms.

Will a stronger European commitment to manned space flight pay off one day in terms of technology? For the first time, the BILD DER WISSENSCHAFT survey of the 100 biggest German industrial companies shows across a broad cross-section just how controversial these companies consider the usefulness of the space program to be. Half of them actually fear disadvantages for European industry if the Old Continent does not make a stronger commitment than it has thus far.

The other half of the companies are of exactly the opposite opinion, foreseeing no detrimental effects. However, it is clearly not the case that firms that are more likely to list in the high-tech column have a more positive assessment of the usefulness of manned space flight than companies in other sectors. On the contrary, according to their responses, prominent high-tech firms such as ANT, Bayer, Hoechst, Siemens, Voith, or Zeiss would apparently have no problems if rigorous cuts were to be made in the ambitious plans for Europe's own manned space program.

But there are a number of companies that can expect practically nothing from the knowledge gained in manned space flight, but which nevertheless express their support for a separate manned space program. This group includes the Bilfinger & Berger construction company, the Saarberg, Bewag, and Bayernwerk energy producers, and companies such as Heidelberger Zement, Adidas, or Jacobs Suchard.

In their assessments of manned space flight, high-tech companies provide extremely differentiated responses: "In the fields of telecommunications, power engineering, environmental technology and earth reconnaissance, materials, robotics, microelectronics, image processing technology, and navigation, the current technological standard could not have been achieved without space flight," says the statement from Daimler-Benz subsidiary Dornier AG. "Industrially useful results can clearly be achieved more inexpensively without manned space flight. We fear disadvantages if Europe makes a stronger commitment," says Darmstadt's Heraeus, in contrast.

Skepticism about manned space flight can also be heard coming from ANT Nachrichtentechnik (ANT Bosch Telecom), headquartered in Backnang, Württemberg: "Manned space flight has only a secondary connection to the commercial application of space technologies. To this day, the commercial usefulness of manned space flight has yet to be proven."

The same line appears to be taken by Siemens research head Dr. Hans Guenter Danielmeyer. According to a company spokesman, he has "a clearly skeptical opinion on the subject of manned space flight." However, Danielmeyer was not willing to formulate a direct statement.

Friedrich Krupp GmbH says that wherever possible, we should fall back on unmanned space projects, or rather the possibilities of automation, robotics, remote control, and remote diagnosis. "Scientific space projects with a pre-competitive character," the Essen company continues, "should be carried out on a broad international basis." Hamburg's Philips headquarters notes: "Whether the posting, maintenance, repair, and replacement of communication satellites will not some day be carried out more effectively by manned space vehicles than by other measures is something that cannot be assessed, at least not by us today."

Only 14 of the 64 companies that responded (another 14 did not respond to the survey, saying that they have nothing to do with space flight) had ever been directly involved in a space project, and had thus been awarded a contract in this field. Thirteen of these were supported by public funding.

When asked, "Does your company already profit directly from the knowledge that resulted from your company's prior space activities?" only five of the 14 companies answered in the affirmative. Zeiss is already profiting directly from the technology and measurement of high-precision optic surfaces and from X-ray mirrors. Dornier admits that discoveries made during the construction of ground stations, in image processing and in data processing, have helped the company to a discernible extent. FAG Kugelfischer, the only company that apparently received no public funding, profits from the experience gained in the space flight sector in terms of materials, designs, and the efficiency of numerous products.

MAN Technologie stresses the discoveries in materials research, and moreover sees spinoff effects in medical engineering. In contrast, Krupp profits from the results that emerged in memory connections. Finally, Frankfurt's Hoechst AG says that it has made slight use of past space projects in fibers and synthetics.

Federal Minister for Research and Technology Dr. Heinz Riesenhuber has apparently neglected to explain to the public why the "future technology of manned space flight" is so important to the preservation of our national economy.

This is suggested by the companies' responses to the question, "At the moment, can you think of any industrially useful consequences that would not have come about without the knowledge gained from manned space flight?" The following were mentioned:

- Computer technology,
- Coating techniques,
- Propulsion systems,
- New materials,
- Improved telecommunications,
- More reliable system engineering.

Do we really need manned space flight in order to further develop these technologies?

Only one company names two products that would not have been developed without manned space flight: non-combustible paper and special food for the astronauts. Otherwise, only one thing was named over and over again: Teflon.

[Box, p 76]

#### German Industry and Space Flight

##### Responses to BILD DER WISSENSCHAFT Questions on Major Projects in Space

	1	2	3	4
Bilfinger & Berger	Yes	Yes	Yes	Yes
Dornier (Daimler-Benz)	Yes	Yes	Yes	Yes
Strabag	No	Yes	Yes	Yes
MAN	Yes	Yes	No	Yes
FAG Kugelfischer	No	Yes	No	Yes
ANT (Bosch)	No	No	No	Yes
Bayer	No	No	No	Yes
Hoechst	No	No	No	Yes
Siemens	No	No	No	Yes
Zeiss, Oberkochen	No	No	No	Yes
Heraeus	No	Unclear	No	Yes
Krupp	Unclear	Unclear	No	Yes

Linde	Unclear	No	No	Yes
Philips	Unclear	Unclear	Unclear	Yes
Bewag	Yes	Yes	Yes	No
Ford	Yes	Yes	Yes	No
Jacobs Suchard	Yes	Yes	Yes	No
Kloeckner-Humboldt-Deutz	Yes	Yes	Yes	No
Papierwerke Waldhof	Yes	Yes	Yes	No
Saarberg	Yes	Yes	Yes	No
Wella	Yes	Yes	Yes	No
Zahnradfabrik Friedrichshafen	Yes	Yes	Yes	No
Badenwerk	No	Yes	Yes	No
Norddeutsche Affinerie	No	Yes	Yes	No
Porsche	No	Yes	Yes	No
VEW	No	Yes	Yes	No
ABB	Yes	Yes	No	No
Adidas	Yes	Yes	No	No
Bayernwerk	Yes	Yes	No	No
Benckiser	Yes	Yes	No	No
Continental	Yes	Yes	No	No
Heidelberger Zement	Yes	Yes	No	No
Roechling	Yes	Yes	No	No
Reemtsma	No	Yes	No	No
RWE	No	Yes	No	No
Suedzucker	No	Yes	No	No
Babcock	No	No	No	No
BMW	No	No	No	No
Dégussa	No	No	No	No
EVS	No	No	No	No
Freudenberg	No	No	No	No
Grundig	No	No	No	No
Kloeckner-Werke	No	No	No	No
Miele	No	No	No	No
Mobil	No	No	No	No
Philip Morris	No	No	No	No
Schering	No	No	No	No
Unilever	No	No	No	No
Voith	No	No	No	No
Walter Thosti Boswau	No	No	No	No

##### Questions:

(1) Should the Europeans maintain their own manned space program?

(2) Do you fear disadvantages for European technology if Europe does not make a stronger commitment to manned space flight?

(3) Can you think of any industrially useful consequences that would not have come about without manned space flight?

(4) Has your company ever received contracts that have to do with space projects?

[Box, p 77]

#### Voices From Industry

**Prof. Dr. Heinz Harnisch, member of the board of directors of Hoechst AG, Frankfurt: We Do Not Need Any Prestigious Projects**

The effect of gravity on chemical reactions is negligible. For this reason, there is no need to study chemical reactions in space. In the field of communication technology and earth observation, space flight can make important contributions to development. However, it is not important here whether such flights are manned or unmanned. Thus, I am in full agreement with the position adopted by the German Physics Association in 1990, according to which the additional expenditure and risk associated with manned space flight furthers efficiency only slightly. Strengthening "ground-based" fundamental research in order to protect our international competitiveness and the restructuring activities in the new Bundeslaender, not least of all in the area of science and research, take precedence over manned space flight, which, although prestigious, is not very profitable.

**Prof. Dr. Karl Heinz Buechel, member of the board of directors of Bayer AG and spokesman for research and development: Cooperation is the Only Road to Take**

Over the past 30 years manned and unmanned space flight has provided an essential impetus to new technological developments. Essential developmental leaps have their origin in spinoffs from space flight, which ever since Sputnik have taken place in the tense atmosphere of competing political and social systems. Through the opening up of the East, the road to technological cooperation between the superpowers is clear. In the present age, which is characterized by increasing cooperation among the highly developed countries it makes little sense to certify Europe's status as a political superpower through a single mega-project, such as manned space flight, especially since existing projects are already highly developed. In my opinion, the only reasonable road to take—because it is the most efficient one—is that of cooperation with the nations already involved in space flight.

**Dr. Helmut Ulke, member of the board of directors of Deutsche Aerospace AG and head of the Space Flight Division: Europe Must Accept the Task**

Space flight encompasses a number of important and indispensable key technologies, the mastering of which will be of critical importance to the markets of the future. European commitment to manned space flight is the technological precondition for exploiting future application potential. The beginning of the next century will be

a pioneering time for a number of decisive innovations in many scientific and technological areas. It is Europe's task to prepare for this innovation in terms of the future range of industrial performance and in order to maintain its competitiveness.

**Dr. Volker Schaefer, head of research for Heraeus, Hanau: The Money is Wrongly Invested**

The usefulness of the European manned space program is totally disproportionate to its costs. All industrially usable results can be obtained at a significantly lower cost using earth-based methods, and "spinoffs" are industrially and economically irrelevant. The Americans and Russians would also include Europeans in their programs if there were no separate European program. By focusing resources on manned space flight, there is not enough money for programs that are much more urgent in order to strengthen European competitiveness.

#### Eureca Experimental Space Platform Being Readied for Launch

92WS0181C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 27 Nov 91 p 8

[Article: "The Reusable Eureca Platform Is Now Ready to Launch; Extensive Transfer of Data from Scientific Experiments/Launch and Return by Means of a Space Shuttle"]

[Text] Frankfurt (Eht)—The first part of its long planned trip around the earth began recently for the Eureca large experimental space platform. The four ton scientific satellite was transported by a jumbo cargo plane from the industrial prime contractor Erno in Bremen to the Kennedy Space Flight Center in Florida. There the Eureca platform with its numerous experiments will be readied for its launch, planned for September of the coming year, into terrestrial orbit by means of the Atlantis space shuttle.

With the development of the free-flying reusable Eureca platform, the European Space Agency (ESA) wants to make a link between the manned Spacelab orbital mission that lasts only a few days and the constantly available Columbus space station that, however, will probably first be ready to use at the end of this decade. The Eureca (European Retrievable Carrier) satellite rings in the era of the industrially used orbital infrastructures, by whose means new materials are to be made purposively under weightlessness in long-duration missions.

The Eureca concept was developed primarily by Germany and Italy on behalf of the ESA. Furthermore, they say, the platform satellite technology totally fulfills the requirements for a cost-favorable, efficient and reusable orbiting experimental carrier. Erno, which belongs to Deutsch [German] Aerospace, in Bremen, used in its design the company's extensive experience in building

the manned Spacelab space laboratory and the automatic SPAS platform, which, however, can be placed in terrestrial orbit each time only for a short period.

The Eureka's modular carrier structure consists of carbon fiber tubes and titanium frame joints that are very light and strong. The manufacturing system and experiments are installed as modules on standardized carrier plates. The Eureka's payload is about 1000 kilograms. It is a matter of 15 individual experiments in the fields of research on weightlessness and materials, as well as life science experiments.

Added to this is the trying out of rendezvous and docking maneuvers as well as the testing of new communication routes. An ion engine for continuous trajectory variation will also be tried out. With the Eureka's payload it is mostly a matter of multiple-purpose equipment with which several experiments can proceed simultaneously or one after the other, so that a total of 57 individual experiments will be completed. Part of the Eureka's experiments will proceed completely automatically in the half-year stay in orbit. Another group can be more or less varied and controlled by the specialists at the earth station depending on the experimentation cycle.

Development of the platform by a European industrial consortium led by MBB-Erno began in 1985. Next the engine and control system were built into the lattice structure by the Italian partner Snia-BPD. Integration of the other systems and the experiments, which have to be easily accessible from the outside, followed next in Bremen. Over 15 kilometers of electrical wiring were laid in the Eureka satellite when the wiring was done.

The Eureka platform is a completely self-contained reusable earth satellite with an orbit attitude control and trajectory variation system as well as a temperature control system. The 1000 watts of electric power are supplied by two large solar cell paddles that are unfolded after launching and are folded before recovery.

Data management is imperative for the operation of so large and complex an orbiting platform and its voluminous scientific payload. Information can be transmitted at a rate of up to 256K bits/s to the ESOC control center in Darmstadt via a parabolic antenna having a diameter of one meter. The results will be stored on a 120-MB-capacity magnetic tape during the 90-minute pass. The results will be forwarded immediately to the institutes and scientists concerned. The results of the weightlessness experiments will directly reach the MUSC user support center at DLR in Cologne.

The Eureka platform will be transported in September 1992 in the 46th shuttle mission by the Atlantis space shuttle to a terrestrial orbit at an altitude of 300 kilometers to begin with, with an inclination of 28 degrees toward the equator. The Swiss payload astronaut Claude Nicollier is responsible for the smooth launching of the satellite on the first mission day in space. Eureka will be transported to the final orbital altitude of 520 kilometers by the on-board engine 140 minutes after launching.

The scientific experiments will proceed on board the Eureka platform during the six-to-nine-month mission. They will always be monitored by the specialists at the earth station. At the end of the mission the satellite will drop again to a lower earth orbit at an altitude of 300 kilometers, where it will be recovered by a transport space vehicle. The experimental apparatus will be dismantled and the results will be analyzed in Bremen. Then Eureka will be thoroughly overhauled and prepared for a new space mission, which could take place in 1995. The platform with minor modifications can also carry other payloads, which will result in considerable cost saving. Still, however, the program is relatively expensive with a total cost of 760 million German marks [DM]. A third of the sum will be raised via German industry participation. Many of Eureka's design and mission features can also be used for the construction of the MTF free-flying laboratory, which Europe will launch into terrestrial orbit toward the end of the decade within the framework of the Columbus space station.

#### Italy: Environmental Applications of Satellites Discussed

92MI0185 Rome AIR PRESS in Italian 4 Dec 91  
pp 2362-2363

[Text] "Despite the current economic situation Italy intends to give high priority to remote sensing technologies," stated Learco Saporito, under secretary for research and universities and in charge of space activities, when he opened the international conference on "Environmental Satellites," held by Telespazio on 29 November in Rome. There are many reasons for this priority, starting with the need to consolidate the leading role Italy has achieved in various fields thanks to decisions made some time ago and to the prospects opening up in the field with Italy's increased role in the ESA [European Space Agency]. Speaking on this subject, Saporito mentioned Italy's contribution at the recent Munich conference to have the resolution on the earth observation program adopted. He stated that, "We will have to make the most of our skills," primarily because the DRS [data relay satellite] telecommunications system is already largely interconnected with this program. The DRS program, in which Italy is the prime contractor, officially entered into the ESA's long-term plan at the same conference. Saporito emphasized the importance of the earth segment in remote sensing, which is essential in processing and elaborating data received from satellites, and also mentioned measures taken in Munich and currently being pursued, to establish more ESA facilities in Italy. This should also strengthen Italy's candidacy as the headquarters for the upcoming European Agency for the Environment. Remote sensing is a field "of major strategic importance, in which our industry is facing strong European and international competition. Companies such as Alenia, Telespazio, Ciset, Laben, Fiar, Officine Galileo, and many others are Italy's strong points, and we are certain that this industrial base can be further expanded," but there is also a need to "ensure the continuity of ongoing

programs to permit selected ministries such as the Ministry of the Environment, Civil Defense, Agriculture and Forestry, Merchant Marine, Defense, etc. to count on the reliable and efficient services," that space activities have made possible. On the other hand, we must push for a more widespread use at a time such as the present when Italian space programs are being reviewed on the basis of an initial search for concrete returns. This must also be carried out within the context of the annual review of ESA programs, requested specifically by Italy.

During his introductory speech Raffaele Minicucci, managing director of Telespazio, also supported the need for a more widespread use of remote sensing from space which can be pursued thanks to a "culture" of territorial and environmental information. Telespazio is contributing to this effort through its participation in numerous projects and programs that are already ongoing or under study. Two of these projects were dealt with specifically during the conference: the Ministry of the Environment's program for coastal areas illustrated by Gianfranco Mascanzini, and ISTAT's [Central Statistics Institute] program for the recent census discussed by Professor Antonio Cortese. Numerous examples of this series of projects were on display by Telespazio at an exhibition at the gallery of Palazzo Colonna where the conference was held. Minicucci mentioned a few of these projects, from monitoring the Adriatic to the "Land of the South" project for agro-meteorological development to the very recent cartography agreement with IGM [Military Geographic Institute]. The sales of data processed by Telespazio have increased from 500 million lire just four years ago to 9 billion; based on this, Minicucci foresees that in the next two to three years, the national market for data on the environment and earth resources will be worth roughly 300 billion lire. Finally, he stated that the space segment may lead to the development of small satellites for individual, specific missions, resulting in lower manufacturing and launch costs.

Remote sensing technologies and their future potential against the backdrop of Italian and European space programs for study of earth were illustrated by ASI [Italian Space Agency] president Luciano Guerriero. After emphasizing that this activity was the only one among the many proposed in Munich to become the subject of an ESA program, Guerriero described its importance in reference to the prospects opening up to Italian industry. In the field of instruments, for example, industry can develop on the basis of what has already been achieved with the ERS-1 [European Remote Sensing Satellite] and the German-Italian X-SAR [Synthetic Aperture Radar] project and by also aiming at second generation SAR and infrared or passive microwave sensors. In the earth segment, Guerriero mentioned the need to strengthen ESA facilities in Italy, especially ESRIN [European Space Research Institute] which will have to expand and take on other functions. He illustrated national projects such as those located in Matera (and managed by Telespazio) to study the solid earth to predict seismic disturbances. Guerriero referred

to the Italian PAF [aerodynamic fort pilotage] that will be inaugurated within a few days. This will differ from others in Europe since it uses new technologies, expressly developed in Italy. Finally, Guerriero reaffirmed the compelling need to create a national policy to fully exploit available resources.

The use of integrated remote sensing techniques (from space, aircraft, and the earth) to manage nature reserves was illustrated by the under secretary of the Environment, Piero M. Angelini. Dr. Richard C. Ciccone of the Environmental Research Institute of Michigan, Sergio Incoronato, director general at the Ministry of Agriculture and Forestry, and Michel Van de Steene of the EEC General Agriculture Division, spoke respectively about applications in agriculture in general, applications specific to Italy, and applications to the EC. The applications of remote sensing in monitoring the marine environment were discussed by Professor Ian Robinson from the Oceanography Department of the University of Southampton, and with specific reference to pollution, by Professor Eugenio Fresi from the Biology Department of La Sapienza University in Rome. The director of the French company IGN International, Alain Couzy, presented an interesting overview of a national remote sensing policy for the territory that could be the basis for the policy to be adopted in Italy. Among the more significant examples concerning the coordination of the tasks of local boards and various ministries, was the urban development plan for Arcachon and water management in the Garonne basin.

## Italy Participates in European Aerospace Projects

### Earth Station

92MI0186A Rome SPAZIO INFORMAZIONI  
in Italian 4 Dec 91 p 5

[Text] A ceremony to lay the cornerstone of the Italian earth station for the reception of data transmitted by the future Italian-French-Spanish strategic observation satellite, Helios, will be held at the Pratica di Mare military airport near Rome on 6 December. Representatives from the Italian and French Ministries of Defense, the Air Force, and national companies involved in the development of Helios led by Alenia Spazio will attend the private ceremony.

### ESA Contracts

92MI0186B Rome SPAZIO INFORMAZIONI  
in Italian 4 Dec 91 p 5

[Text] Kayser Italia of Leghorn has recently received new contracts from the ESA's [European Space Agency] ESTEC [European Space Research and Technology Center] worth roughly 3.5 billion lire. Apart from "phase B" for the study of the LSF [Liquid Structure Facility], the company has started "phase C/D" for the Biobox incubator for microgravity studies. This will be launched in November 1992 with the Soviet capsule Photon during the Bion 10 mission. Kayser Italia is also

involved in the development of two Biopan containers for biological samples, to be mounted outside the Photon or Resource capsules. Biopan's first test flight is scheduled for May 1992.

### **Columbus Fluid Physics Laboratory**

92MI0186C Rome SPAZIO INFORMAZIONI  
in Italian 4 Dec 91 pp 3-4

[Text] Carlo Gavazzi Space has recently been assigned an ESA contract for the "Fluid Physics Laboratory" aboard the future Columbus space module. The ESA contract was in fact assigned to an industrial group led by Carlo Gavazzi Space and which comprises German, French, and UK companies from the Europe payload consortium. The Italian company's experience in this sector includes the development of the Anthrolab, Botany Facility, and MGIM (Microgravity Isolation Mount) as well as sophisticated vision systems for Columbus and the BPDU [bubble, drop, and particle unit] fluid physics laboratory aboard spacelab.

### **Italy: Future Space Programs, Funding Discussed**

#### **Scientific Research Minister**

92MI0187A Rome SPAZIO INFORMAZIONI SPAZIO  
ITALIA Supplement in Italian 20 Nov 91 pp 4-5

[Article by the Under Secretary for Universities and Scientific and Technological Research, Senator Learco Saporito: "Italy's Space Conquest"]

[Text] The geopolitical scene in Europe is changing radically with the democratization process under way in eastern Europe, the disintegration of the Soviet Union and the Warsaw Pact, and the unification of Germany.

In the Far East, we are witnessing the growing industrial and economic power of Japan, and the efforts being made by China to reach a high level of industrialization.

Latin America, weighed down by huge debts to industrialized countries, is asking for financial aid and industrial investments in order to emerge from a serious crisis.

The United States instead is entering into new working agreements with the Soviet Union, agreements that, once implemented, will influence the world geopolitical setup. We therefore find ourselves in a delicate phase of transition toward a new world order founded not only on political cooperation, but also on increased industrial competition as new and powerful rivals adopt the market economy.

### **The Strategy of Italy's Space Policy**

Within this framework my Ministry [Ministry of Universities and Scientific and Technological Research] has defined a strategy to support Italy's space policy that is based on:

- participation in European Space Agency (ESA) programs;
- space programs with the United States, such as the Tethered satellite and logistics module for the international space station Freedom;
- scientific and technological bilateral cooperation with new partners: more precisely, agreements have been signed with the Soviet Union and China;
- development at a national level.

This strategy has thus outlined a role for Italy which includes international cooperation, top level participation in ESA programs as the third-ranking participating country behind France and Germany, and development at a national level. The objective is to enable Italian firms to compete in high technology sectors and permit our scientists to participate in specialist space research projects.

We intend to consolidate and increase the scientific, industrial, and technological skills linked to space activities, since this is an area of great strategic importance for Italian industry: firms such as Alenia Spazio, BPD, Telespazio, Ciset, Laben, Fiar, Galileo, and many others, are Italy's strong points in an international scene characterized by growing competition.

### **The Numerous Programs Under Way**

Italy has recently handed over to NASA the Tethered satellite that will travel with the American space shuttle and, for the first time in history, an Italian astronaut will take part in the mission on board the shuttle.

Together with Germany, our firms are developing a radar for use on board a NASA shuttle for research in the field of remote sensing from space. We play a leading role in remote sensing via satellite, as in satellite telecommunications (take, for example, the successful Italsat launch), thanks to an able and far-sighted industry and high-ranking scientists, and, if I may say so, to the constant efforts of my ministry. Mention should be made here of our collaboration in the program for the development of two DRS [data relay satellite] satellites to relay data from European observation satellites back to earth in which Italy is the leader and our industries prime contractors.

Moreover, we should not forget that Italy has a primary role in the program for the development of the pressurized module as Europe's contribution to the international space station Freedom.

Another important sector is represented by earth infrastructures, essential for optimum exploitation of space missions. Italy not only houses Europe's first and largest station to receive satellite-relayed data (Fucino) and the ESA's Olympus satellite control center but is also the location of an ESA center (ESRIN [European Space

Research Institute] in Frascati, near Rome) that processes environmental data acquired from satellites in orbit for the rest of Europe.

We intend to strengthen the role of these structures in Italy both for ESA and national programs (such as the ASI [Italian Space Agency] space geodesy center in Matera).

The means of implementing such a far-reaching policy is the 1990-94 National Space Plan, recently approved by CIPE [Interministerial Committee for Economic Planning]. This plan bears witness to the effectiveness of the strategic decisions taken by the government during the last 1987-1991 five-year plan and at the ESA ministerial conference held at The Hague in 1987.

#### **The ESA's New 1992-2005 Long-Term Plan**

At present, preliminary meetings are being held at a European level to define the ESA's 1992-2005 long-term plan which includes important projects such as the development of the Hermes space shuttle, the Columbus program, the DRS satellite system and the polar platforms. The ambitious plan is Europe's way of reaching space independently. Italy has been called upon to assume an important role in all the projects, as acknowledgement of its high technological and scientific achievements.

Italy's future prospects are therefore based on its constant striving for success in the past, which are now part of its heritage. This means we can continue with our commitment and strengthen Italy's presence both through international cooperation agreements and participation in ESA programs and by development at the national level.

#### **1990-94 National Space Plan**

*92MI0187B Rome SPAZIO INFORMAZIONI SPAZIO ITALIA Supplement in Italian 20 Nov 91 pp 14-16*

[Text] The 1990-1994 National Space Plan, the first five-year plan to be drawn up by the ASI [Italian Space Agency], defines the entire range of space activities in Italy and for the first time includes programs for participation in ESA [European Space Agency] projects.

#### **The International Situation**

Space activities are expanding considerably at world level, where the level of funding allocated by the United States and the USSR is 10 times that of Europe, and where Europe has given a considerable boost to the sector, mainly through the ESA program.

Italy has reached an enviable position in this sector, ranking third behind France and Germany as well as the title of "leader" country in decisions on European policy, a policy that will be established at the forthcoming conference of European research ministers.

Italy's constant advancement in the sector has been made possible by the funding that government has constantly allocated to space activities which, until 1989, amounted to 3 trillion lire, 1.4 trillion of which were for national projects.

The 1990-1994 five-year plan takes this situation into account and defines specific strategies to permit Italy's private and public customers, for research or applications, to carry out activities with a high scientific and technological content in a far-reaching international context.

At the same time the plan involves implementing a series of programs to achieve a satisfactory balance between greater financial investments, an increase in industrial employment, expansion of basic research, as well as satisfactorily developing strategic policy guidelines for training for southern Italy.

The basic guiding principles, of the 1990-1994 plan, which are fully consistent with the guidelines for development consolidated in previous years, are the following:

1) the paramount importance of basic research, which has been allocated 15 percent of the funding for national programs, in compliance with the articles of incorporation in the ASI. Within this context, great attention has been focused primarily on developing scientific payloads for national satellites, those of the ESA, and other agencies;

2) giving a strong boost to industrial development. The goal of the plan is to strengthen national systems capabilities, upgrade industries at subsystem level, promote market initiatives and create services, and upgrade testing facilities. In addition to major projects assigned to firms with integration and systems capabilities, important technological schemes involving firms with specialist capabilities will be carried out to increase their competitiveness;

3) combine schemes designed to promote the establishment of new high technology facilities in southern Italy to provide wide-ranging spin-offs in the manufacturing sector. This includes operational guidelines to promote activity in the South in strategic sectors, such as earth observation, microgravity, robotics, and advanced materials technology;

4) consolidate training schemes in line with requirements in the space sector to improve the quality and quantity of personnel in companies and national research structures which, compared with the situation in Europe, are not yet fully satisfactory or sufficient;

5) create a substantial balance between national activities and Italian participation in the ESA. Only a well-balanced space policy can give rise to stronger national industrial capabilities which, through sufficient funding, can further specialize and better compete at an international level;

6) high-level international recognition. In line with developments during the past decade, bilateral and trilateral cooperation agreements will be consolidated, not only through the traditional alliances with the United States and with the major European countries, which are still permanent landmarks, but also by extending accords to new countries such as the former USSR, Japan, and China;

7) promoting schemes aimed at improving coordination with national authorities and organizations responsible for carrying out operations relating to the development of space activities. Measures are being taken to identify areas for joint intervention where financial participation by the authorities and organizations involved is also envisaged.

#### Activities in the ESA

The National Space Plan confirms the effectiveness of the strategic decisions taken by the government in approving the last 1987-91 five-year plan and the ESA ministerial conference held at The Hague in 1987.

The investments planned for the years to come are mostly determined by the national and ESA programs currently under way.

Investments for the major ESA programs are based on the medium-term plan that will certainly be reviewed at the ministerial conference in November.

As far as ESA programs are concerned, the commitment assumed previously for Columbus, Ariane, Hermes, and the DRS [data relay satellite] is confirmed.

Italy in fact will continue its 25 percent funding of the completion of Columbus and its related programs, including that of the polar platforms, assigned to an Italian/German company (Columbus Space) to which both countries contribute.

As regards ESA programs for space transport systems, Italy's investment in Ariane-5 and Hermes is fixed at 15 percent for activities which involve Italian industry at satisfactory levels in terms of returns and technological progress.

#### 1990-94 NATIONAL SPACE PLAN, Financial Investments

	1990	1991	1992	1993	1994	TOTAL
Existing commitments	957	1050	1089	1059	992	5147
New schemes	51	104	181	189	219	744
Preparation	20	54	86	96	103	359
Plan total	1028	1208	1356	1345	1314	6251
Future programs	18	160	365	623	763	1929

(to be submitted to CIPE\*)

Total	1044	1368	1721	1967	2077	8180
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(Plan + future programs)

Figures in billions of lire at 1990 levels

\*Interministerial Committee for Economic Planning

(Source: ASI)

#### 1990-94 NATIONAL SPACE PLAN, Division of National/ESA Activities

	NATIONAL	ESA	TOTAL
Organization	345.0	186.0	540.0
Bases/operations	287.5	55.2	342.7
Basic research	345.6		345.6
Technological research/studies	280.0	116.3	396.3
Scientific satellites	532.5	305.6	838.1
Telecommunications	312.0	655.2	967.2
Earth Observation	378.0	98.3	476.3
Orbital infrastructures	188.6	774.8	963.4
Space transport	268.0	1113.0	1381.0
TOTAL	2946.2	3304.4	6250.6

Figures are in billions of lire at 1990 levels

(Source: ASI)

DRS, in line with the decisions taken at the conference in The Hague, is a program with a substantial national financial investment (45 percent), given that Alenia Spazio will be the prime contractor.

### The Programs of the Plan

The major domestic programs under way are:

- 1) the Tethered satellite, to be launched in 1992 in collaboration with NASA,
- 2) Lageos-2, for a geodesy mission, whose launch is scheduled for 1992, in collaboration with NASA;
- 3) the SAX program for high-energy x-band astrophysics mission jointly with the Netherlands to be launched in 1993;
- 4) the SAR [synthetic aperture radar]-X radar program with Germany and the United States, scheduled for launching in 1993.

The new projects include the following:

- 1) collaboration with NASA on the Cassini interplanetary mission, for a close-up study of Saturn;
- 2) the launching of a bilateral program with NASA for the logistics segment of the Freedom space station;
- 3) developing the prototype of the San Marco Scout carrier and its Italianization for small satellite launches;
- 4) developing two small intelligent satellites for earth observation and microgravity.

These projects supplement those aimed at giving basic research a strong boost as stated in Law No. 186.88, and at technological developments. These new projects were in fact chosen to maintain:

- 1) a balance between activities organized directly by the ASI and those assigned to the ESA;
- 2) developing proposal capabilities within the ESA, in view of the ministerial conference;
- 3) a satisfactory degree of collaboration between the ASI and NASA, which has proved to be extremely important for the growth of Italian expertise and increased competitiveness within the ESA;
- 4) the leading role of basic research;
- 5) a balanced investment between the systems and specialist sectors of national industry.

If, on the one hand, ESA investments appear to favor activity linked to new systems for the permanent occupation of space, national investments encourage the development of the Earth observation sector, which is certainly considered to be strategic due to its future scientific and commercial impact.

The new projects also include developing activities in areas such as telecommunications and Earth observation which, in addition to their undoubted scientific and technological value, have operational features that can be applied by authorities and organizations in charge of coordinating the capabilities and services of space facilities.

1990-94 NATIONAL SPACE PLAN, Division Per Program

	1990	1991	1992	1993	1994	TOTAL
Organization	80.4	98.3	111.5	121.9	127.9	540.0
Bases/operations	45.8	73.5	82.4	71.9	69.1	342. 7
Basic research	79.6	74.8	71.8	64.1	55.3	345.6
Technological research/studies	46.2	72.9	92.2	90.0	95.0	396.3
Scientific satellites	208.1	212.5	189.9	149.3	78.3	838.1
Telecommunications	233.5	182.8	191.7	183.7	175.5	967.2
Earth observation	66.7	103.2	104.0	109.5	92.9	476.3
Orbital infrastructures	70.6	145.2	210.5	242.0	295.1	963.4
Space transport	196.4	245.2	302.2	312.2	325.0	1381.0
TOTAL	1027.3	1208.4	1356.2	1344.6	1314.1	6250.6

Figures are in billions of lire at 1990 levels

(Source: ASI)

### Italian Space Agency Director

92MI0187C Rome SPAZIO INFORMAZIONI SPAZIO ITALIA Supplement, 20 Nov 91 pp 17-18

[Interview with Carlo Buongiorno, director general of the Italian Space Agency, by SPAZIO ITALIA; place not specified: "Italy Bets on Space"]

[Text] SPAZIO ITALIA: The new 1990-94 National Space Plan was fully approved by CIPE [Interministerial Committee for Economic Planning] last summer. Now, however, parliament is assessing the funding for 1992 within the context of the budget. What forecasts can be made?

Carlo Buongiorno: The plan, as everybody knows, has no legislative value, but is merely a program that must be

backed by funding decisions. When government approves a decision to plan space activities in this way, for the agency this already means, in a certain sense, credit on the budget. Government cannot then decide to "cut" space activities in the budget, and is obliged to give the same importance to these activities as provided for in the five-year plan. There are two phases therefore, the planning phase and the resource phase. Parliament, in that it expresses the will of the country, cannot but take into account that this objective, having obtained government approval, is included in the budget. The plan we have proposed merely concerns basic research for progress in national space technology. Our plan does not include requests to fund the use of these infrastructures and technologies. We supervise development for future use by others.

**SPAZIO ITALIA:** How will other government authorities be able to use ASI's technological developments for their own activities?

**Buongiorno:** A typical example is the Italsat-1 telecommunications satellite that was launched at the beginning of this year and works perfectly.

Now it is the turn of Italsat-2, in which SIP [Italian State-Owned Telephone Company] has shown an interest. This is the first case in which the ASI has created "something" useful, that will be integrated into the national telecommunications system.

Then we have the Ministry of the Environment, which may need satellites to monitor woods, pollution levels, or ozone. The Ministry of Civil Defense may also be interested in a mobile monitoring and communications system to use in the event of disasters. We are laying the foundations and preparing the tools that can be exploited by others.

**SPAZIO ITALIA:** The new projects for the use of space technologies are therefore truly important.

**Buongiorno:** Naturally. If we want to increase the number of people working in this sector and thus increase the volume of business, we cannot base ourselves solely on ASI R&D projects. The Ministry of Civil Defense, for example, should order its own satellites, as should the Ministry of the Environment.

The Italian space industry, in the future, cannot support itself with the R&D funding that the ASI, by law, must manage. We must act as a catalyst for all in Italy, to permit them to use the tools we have developed. It is important to keep this activity in motion.

To date the only resources available are those allocated under the budget to the ASI. New funding must therefore be collected outside of the ASI.

**SPAZIO ITALIA:** What are the prospects for the coming year?

**Buongiorno:** When drawing up the budget for 1992, despite the recession, the government allocated a 10 percent increase to space activities compared to 1991.

This means that, in a situation where other research funding has been cut, space has received an increase.

This has been the policy followed by the government in the past 10 years, a policy which has always been approved unanimously by parliament, including the opposition.

This is being done in the belief that the leading-scale technological value of space activity, which is multidisciplinary, is also a means for international collaboration.

Moreover, next year, the ASI will be the only major European agency to have a considerable number of launches. By a strange coincidence 1992 is International Space Year and the 500th anniversary of Christopher Columbus's voyages, we will launch the Tethered and Lageos-2 satellites, the latter using Italy's IRIS [Italian Research Interim Stage].

**SPAZIO ITALIA:** A problem-free year then.

**Buongiorno:** There are problems, but of a domestic nature. This huge volume of activity is still managed by a small number of people. It is an excellent group, but numbers only about 100. I hope that by the end of next year the number will at least double. If we manage in this way to solve our problems then in 1993, when ASI's first five years of activity come to an end, ASI chairman Guerriero and myself can truly say that we have given our country an agency that has accomplished its objectives.

### **European, French Competitiveness in Space Transport**

*92WS0195A Paris DEFENSE NATIONALE in French  
Nov 91 pp 141-146*

[Article by Jean-Louis Bassano, of the Industry Ministry's Industrial Strategies Observation Bureau: "Space Launchers: Chinese Shadows Over Ariane?"; first paragraph is DEFENSE NATIONALE introduction]

[Text] Jean-Louis Bassano, head of the Defense and Space Industries Section of the Industry Ministry's Industrial Strategies Observation Bureau, has already published in our magazine, in July of this year, a study on defense industries as from the start of the third millennium. In this new article, he offers his thoughts on what the space transport market will be like during the 2000's [years 2000-2010], and on the outlays France and Europe will have to be competitive in a rapidly expanding world market.

Space transport today embodies the mastery of a complex technical and industrial system, and a competitive international market. Europe, with limited resources (European spending, on space, currently totals approximately one tenth that of the Americans), has succeeded

in developing a space-transport technical system (launch infrastructures, launchers) that has earned for it what, since the mid-1980's, has been the top rung in the market for commercial launches, a market estimated at between \$0.8 and \$1.2 billion, Europe's share of which varies between 50 and 75 percent—and a market the supplying of which, owing in part to the space policy and technology transfer policy of the United States, is limited to two operators with very unequal means and orientations.

The European consortium's dominant position in the space transport market is, in fact, fragile. The emergence of other space powers (China today, the newly industrialized countries [NIC's] soon), and of a new space-transport technical system (in the United States, and Japan), will rapidly diminish Europe's role in this domain if Europe does not at least double its current outlay.

#### **Space Launchers of the 1990's; Toward a Buyers' Market**

The evolution of the United States' space policy toward the end of the 1980's, the opening of the commercial space-transport market to China, and very likely to the Soviet Union around the beginning of the 1990's, and the outcome of Japan's space technology program as from the mid-1990's on, are certain to rapidly transform the launch market. The ratio of launcher supply to demand could well be around 2 to 1 by the middle of the decade.

The privatization of space begun by the Reagan Administration around the mid-1980's, with the object of improving the productivity of the space budget by resorting to the marketplace, and of encouraging industrial investment in emerging technologies, gave a fresh impetus to the production of expendable launch vehicles [ELV's] in the United States.

Since 1990, American industry is able to offer:

—Launchers capable of putting payloads of 2 to 5 tons into low earth orbit (Atlas 1, Delta 2, Titan II) and in geostationary earth orbit (Atlas 2, Titan III), hence comparable to Ariane 3 and Ariane 4;

—A flexible launcher capable of putting a payload of 20 tons into low earth orbit, and 5 tons into geostationary orbit (Titan IV), hence comparable to Ariane 5.

General Dynamics (Atlas), Martin Marietta (Titan), and McDonnell Douglas (Delta) are thus capable of developing a commercial space transport activity.

Until near the end of the 1980's, the United States had insisted that its industrialists, and those of Europe and Japan, adhere to the provisions of Cocom [Coordinating Committee on Export Controls], which prohibited the deployment of Western satellites by Chinese or Soviet launchers. This prohibition was lifted in 1990 with respect to China, and will probably be lifted with respect to the Soviet Union in the early 1990's.

China offers a launcher today that is capable of putting a 10-ton payload into low earth orbit (Cheng Zen 2E), and is preparing another one capable of putting a payload of 2 to 3 tons in geostationary earth orbit (Cheng Zen 3A). Both are of a quality equivalent to that of their Western competitors, at about half the corresponding prices. And Great Wall Industry is developing a flexible launcher comparable to Ariane 5, with completion targeted for the end of the 1990's.

The Soviet Union offers two launchers of the Delta class capable of putting 5 to 7 tons in low earth orbit (Vostok, Soyuz), a flexible launcher of the Titan class capable of putting 20 tons into geostationary orbit (Proton), and a heavy launcher capable of putting 100 tons into low orbit and 20 tons into geostationary orbit (Energiya). The latter has no equivalent since the abandonment of the Saturn V heavy launcher around the middle of the 1970's.

Japan has embarked on a program aimed at mastery of an independent space transport technology. In the case of the H1 launcher (Mitsubishi H1, Nissan), of the Delta class, its partial resort to a technology developed by Rocketdyne and Thiokol for the first stage of the Delta 2 launchers precludes any commercial application thereof. But as from the mid 1990's, Japan is expected to be able to offer a flexible "indigenous" launcher of the Titan class, capable of putting 10 tons into low orbit, and 5 tons into geostationary orbit (H2), hence comparable to Ariane 5, and a space shuttle capable of serving a space station and of both manned and unmanned flight (Hope), comparable to Hermes.

The European consortium and the American industrial operators represent a capability of 30 to 40 commercial launches annually, to which China and the Soviet Union, and subsequently Japan, will be progressively adding a capability of 10 commercial launches annually, for a demand that is expected to remain relatively stable over the next 10 years at between 15 and 20 launches a year.

If just NASA alone deploys its space station, whose specifications as of now are premised on a requirement of some 100 missions, the space transport market of the 1990's will be a buyers market.

#### **Forthcoming Space Transport Technical System**

The current space transport technical system, the product of technologies of the 1960's, is now approaching the limit of its potentialities. The assembly and maintenance of permanent orbital infrastructures, the installation of a lunar base, and a mission to Mars, will require space transport systems (ground-based equipment, launchers) representing a qualitative leap (in terms of safety, flexibility, and capacity), at costs (fixed and variable) divided by one order of magnitude.

Technological maturity is being signaled by a proliferation of private operators (Space Services' Conestoga light launchers; Orbital Sciences' Pegasus and Taurus; Avibras and Great Wall Industry space center projects in

Brazil; and United Technologies and Glavkosmos space center projects in Australia) and of space programs. India's and Israel's ambitions are essentially political; but Taiwan and the Republic of Korea have the means for producing commercial launchers by the turn of the century.

The United States and Japan have undertaken to develop, by the years 2000-2010, the next generation of space transport technologies.

The unmanned freight shuttle (Shuttle-C/Z) that is to provide NASA with an unmanned launcher by the mid-1990's, capable of putting 75 tons into low orbit, and enabling NASA to limit the use of a manned launcher for which the probability of catastrophe is still in the order of 1/80, is but a transitory solution linked to the planned subsequent deployment of a space station. The development of the next generation of space-transport system is in actual fact taking place in the United States, under three long-range plans focused on the beginning of the year 2000.

The U. S. Defense Department's ALS (Advanced Launch System) program, spearheaded by Martin Marietta, is developing, and targeting for the year 2000, a set of generic technologies (ground-based equipment and operations management, materials, new propulsion systems) that will be used initially for an unmanned heavy launcher capable of putting payloads of 100 tons into orbit at a cost of around \$0.3 million per ton of payload. The cost today ranges between \$3 million and \$5 million per ton of payload.

NASA's AMLS [Advanced Manned Launch System], spearheaded by Rockwell, is developing, for the mid-2000's, a manned shuttle (orbiter) and an orbiting, fully reusable, transport vehicle (propulsion system). These are to provide manned links with and between space stations.

The joint NASA and Defense Department NASP (National AeroSpace Plane) project, spearheaded jointly by General Dynamics, McDonnell Douglas, Rockwell, and United Technologies, is developing a space plane capable of flying at Mach 25 and of putting payloads of 15 tons into orbit, and whose maintenance can be performed in a matter of hours by some 100 persons (that of the Shuttle today requires some three months and some 10,000 persons). It would utilize commercial installations. A prototype (X 30) is targeted for the end of the 1990's, with the regular system to be operational by the mid-2000's.

Japan is currently developing technologies under its H 2/Hope program—involving materials (Ishikawajima Harima HI [Heavy Industries], Kawasaki HI, Mitsubishi Metal, Nippon Steel); propulsion (Mitsubishi HI, Nissan); and navigation and flight control systems (Fujitsu, Mitsubishi Electric, NEC)—that go well beyond the needs of a launcher of the Ariane 5-Hermes class. While the H 2 will not be highly competitive in the space-transport market by the end of the 1990's, the program is

in fact preparing mastery of the next-generation technologies that will be turned to good account, as from the mid-2000's, in advanced launchers and in a space plane (Ishikawajima Harima HI, Kawasaki HI, Mitsubishi-HI, Nissan). These will all be comparable to those under development in the United States (ALS, NASP).

The maintaining of a significant European position in space, as from the end of the 2000's, will depend on outlays that must be undertaken today, and for two reasons.

First, Ariane 5 and Hermes will not remain the competitive launch system that it may be at the outset of the first decade of 2000. The space activities of the next generation (assembly and operation of large-scale orbital and planetary installations) will be based on the big space powers' next generation of space-transport technologies (ALS, AMLS, and NASP). The traditional space activities (launching of satellites) will fall back on mature technologies (conventional launchers owned and operated by new space powers).

Second, Europe's experience, like Japan's, in their space relations with the United States, have shown the importance of self-sufficiency in this domain. Europe must decide its own programs irrespective of terms laid down by the big space power, and must have its own ground-based equipment, orbital infrastructures, and launchers. The United States does not consider Europe a major power and will not agree to terms of cooperation consonant with Europe's interests unless Europe masters the most sophisticated space technologies on its own.

Development of the next generation of space launchers—an unmanned heavy launcher (ALS), an unmanned transport and reusable manned transport system (AMLS), and an aerospace plane (NASP)—represents an outlay of some \$20 to \$30 billion over a period of 10 years. This would mean doubling ESA's current space expenditures, but it would still amount to only about one fifth of NASA's.

### **Germany: Saenger Program Risks Under Consideration**

*92WS0200A Stuttgart FLUG REVUE in German  
Dec 91 pp 12-14*

[Text]

### **Risk Too High for Space Transportation System of the Future?**

#### **Criticism of the Saenger Program**

Is the research minister betting on the wrong horse for the future space transportation system? Experts estimate that the risk for development of the two-stage Saenger system is very high. Thus funds, which are tight in any case, could flow in the wrong direction.

The Saenger horizontal take-off fully reusable space transportation system proposed by MBB [Messerschmidt-Boelkow-Blohm] is supposed to open up a cheaper route into space. The two-stage design provides for an air-breathing hypersonic space plane which carries the rocket-powered upper stage piggyback from take-off from an ordinary commercial airport up to an altitude of 31 km. The upper stage, after flying for a distance at Mach 6.8, is then to be separated near the equator and continue its mission alone. Within the framework of the "Hypersonic Technology" program supported by the Federal Ministry of Research and Technology (Bundesministerium fuer Forschung und Technologie, BMFT), work has been carried out since 1988 on the fundamental principles for the lower stage, technically demanding because of the large range of flight speeds which it must manage.

Reason enough for the German Bundestag's Office of Technology Assessment (Buero fuer Technikfolgen-Abschaetzung) to investigate the technological risk of the Saenger space transportation system. And that, as confirmed in a preliminary study by the DLR [German Aerospace Research Establishment], is anything but small. Without a good command of the appropriate technologies, the Saenger project cannot be carried out.

One reason for the high standards is that both Saenger stages must glide back to Earth. Therefore the classic blunt form of the re-entry vehicle, seen for example in the American space shuttle with its low lift to drag ratio, can no longer be used for Saenger because a relatively high lift-drag ratio must be achieved for both stages. The sharply tapering configurations required have led to a "marked increase" in technical problems, particularly in the calculation of boundary layers, heat protection, and thermal balance, to say nothing of the enormous demands on aerodynamic features. Here "to make Saenger a reality" the DLR experts see the necessity for "considerable developmental work, at least in materials and the computing method based on computational fluid dynamics (CFD)" which have "still not attained a level sufficient for use in development."

#### Active Cooling of the Surface

It is still possible to fall back on a few practical experiences in aerothermodynamic design. On the other hand, the technology of air-breathing hypersonic propulsion is "completely new territory."

An example: The high temperatures in the engine's ram intake require active cooling of the hot surface in order to control the thermal balance. The same holds true for the turbines, as long as no fiber-reinforced ceramic materials are available. The study expects "that the cooling capacity will suffice if there is medium-range development of high-temperature alloys. For the maximum permissible temperature of today's materials, however, we must contend with a bottleneck." That means that from the present perspective, a solution to the problem can hardly be foreseen.

A further key function—likewise a consequence of the great range of speeds and the extreme temperature stresses which result—is assigned to the area of materials and construction technology. "Saenger can only become a reality if it is possible to develop heat-resistant structures with extremely low weights per unit area from material with high mass-specific characteristics." From the national perspective, the study sees an enormous need to catch up "with the leading manufacturers in the USA (metal matrix composites), Japan (fiber manufacture) and France (ceramic matrix composites)."

Regarding thermal protection systems, the authors of the preliminary study also view the manufacturing technologies and jointing techniques for active cooling with an integrated cooling tube system as unavailable—pure tile construction like that in the space shuttle is no longer adequate for Saenger.

The DLR scientists deliberately put a question mark behind the title of the preliminary study "The Space Transport System—Cheaper in Orbit?" since Saenger would be "more expensive than the alternative, Ariane 5/Hermes, because of the high development costs with respect to its service life costs." Compared with the original plans, estimates for the development costs of Saenger have doubled today to about 45 billion German marks, while less than half suffices for Ariane-5 and Hermes.

Regarding operational profitability, the study comes to the conclusion that development can only support itself if the demand for transportation for both manned as well as unmanned missions increases sharply and the world market is dominated to the greatest possible extent by the Saenger system.

Such a scenario is not foreseeable today. Nevertheless, the DLR's policy states: "Since work is being done on hypersonic technology concepts in almost all nations involved in space flight, it may be necessary to support this from the standpoint of competition."

#### ESA: Four New Space Missions Forecasted

92WS0200B Stuttgart FLUG REVUE in German  
Dec 91 pp 14-15

[Text]

#### ESA Plans New Space Research Missions

##### Mars Mission in the Quarter Finals

The final round has begun. Four space missions are on the short list for the second Medium-Size Scientific Project (M2) in the ESA's [European Space Agency] scientific program: a network of unmanned stations on Mars, two astronomical satellites, and an experiment for testing one of the basic laws of physics.

The goal of the "Horizon 2000" research program, created by the ESA in 1984, is to take a look over the horizon into the next millennium. Along with the four

large projects, Soho/Cluster, Rosetta, XMM, and FIRST, which form the pillars of the program, there are four medium-size and several small projects. As the first medium-size project (M1), the Huygens Probe together with NASA's Cassini satellite is to take off for Saturn in 1995 and land on the Saturnian moon Titan. A preliminary selection for the second medium-size mission (M2) was made by the Space Science Advisory Committee (SSAC) in April of this year. Four of the 22 candidates made it to the final round.

Life on Mars—this idea has fascinated mankind for centuries. It has indeed long been clear that life is impossible under present conditions on Mars, but now the MARSNET probes are to determine whether biological activity was ever present during its history. From these investigations, scientists hope for clues to the origin of life on our own planet and to the question of whether the Earth is unique in our universe. In the basic configuration, an orbiter is to be fired into a Mars orbit with a launch vehicle, like the Ariane-5, and from it three Mars landers will then be set down on the Martian surface at intervals of about 3500 km. These mutually independent probes form a network with which seismological and meteorological measurements can be made. Not only is data to be gathered on the weather and Marsquakes, but mineralogical and chemical investigations of the surface and the Martian atmosphere will be carried out as well. The orbiter will serve as a relay station and transmit back to Earth data collected by the probes, which measure about 90 cm and weigh about 80 kg. In order to obtain a clear picture of processes on Mars, a service life of one Martian year (687 days) is planned. The network can be extended even further by cooperation with other Mars landers, e.g from NASA's MESUR Program.

#### Decision Set for Spring 1993

A further candidate is INTEGRAL, an international gamma ray and astrophysics laboratory, which is conceived as the successor to NASA's Gamma Ray Observatory (GRO) and is to have a 10-fold to 100-fold higher resolution than it and other satellites. With a positioning accuracy of less than 20 arc minutes, it will make it possible to localize the sources of gamma rays precisely for the first time. The satellite's instruments are to track line spectra in the 15 keV to 10 MeV range which originate primarily as a result of atomic processes. It is hoped this will reveal new information on the center of the Milky Way, supernovas, and other phenomena. Gamma-ray bursts and other short-term phenomena are also to be studied. The two principal instruments, a germanium spectrometer and a cesium iodide scintillator, will be supplemented by an x-ray monitor and a transient camera in the visible region. This combination is necessary in order to be able to link gamma-ray sources with their counterparts emitting in the optical, infrared, and radio wave regions and to eliminate confusion. Depending on the orbit, either a Titan-III (HEO) [high-Earth orbit] or an Ariane-4 (LEO) [low-Earth orbit] is planned as the launch vehicle.

What are stars? The PRISMA mission is supposed to find an answer to this question and thus close the gaps which have opened up between theoretical models and measurements in the study of our sun. Our sun pulsates regularly because of internal pressure waves. The study of this phenomenon is now to be extended to other stars. Two photometers, a UV spectrometer and a telescope that operates in the extreme UV, are to be directed long-term towards certain regions of space in order to record these periodic variations, which range in time from minutes to days. This will enable scientists to test their theories for the first time on the processes in the interior of stars.

The fourth experiment on the short list is of quite a different nature. STEP is supposed to test one of the basic laws of physics, the principle of equivalence, and to do this it repeats, in a certain sense, an experiment of Galileo Galilei in which he dropped two bodies from the Leaning Tower of Pisa. If this experiment is transferred to space, then that corresponds to a tower several thousand kilometers high. Simply put, the principle of equivalence states: In a vacuum, all neutral bodies fall with the same acceleration, or inert mass and gravitational mass are indistinguishably identical properties of all bodies. A difference in free-fall between two objects would contradict this principle and with it, Einstein's general theory of relativity as well. The execution of such free-fall experiments inside a satellite makes it possible to demonstrate the principle of equivalence with unprecedented precision. This will also permit a 100-fold more accurate determination of the gravitational constant, hitherto known with accuracy only to the third decimal place. This has serious consequences for astronomy, since with it the masses of stars and other heavenly bodies can also be calculated a hundred times more accurately. But there is something to be gained for other areas of research as well. Since the satellite is supposed to orbit the Earth at a relatively low altitude, all disturbances caused by the atmosphere must be compensated for with attitude control systems. The necessary control impulses then allow inferences to be made concerning atmospheric composition and processes. The satellite could be launched with commercially available rockets and is designed for a service life of six months.

Technical implementation of the four missions under consideration for the ESA's next M2 project are now being investigated in a further study phase in which industry will be consulted as well. In spring of 1993, the final decision will be made on which mission will be carried out.

#### Ariane-5 Solid Booster Slated for Recovery, Checkout

92WS0200C Stuttgart FLUG REVUE in German  
Dec 91 p 22

[Text]

#### Recovery of the Ariane Booster

The Ariane-5 will be a traditional expendable rocket. Nevertheless, the two large solid boosters are to be

recovered for technical checkout following the first test shot. For design of the multistage recovery system's first parachute, it is important to know how the burned-out rocket stage orients itself relative to the flight path. Therefore, tests were conducted with a 1:75 model in wind tunnels of the Dutch NLR. In order to be able to simulate the descent, engineers developed a mount with which the model can be moved hydraulically up to an angle of incidence of 90 degrees and then back again to the zero point within 25 seconds. In later operational service, the Ariane-5 solid boosters will fall back to Earth after burnout. Recovery is no longer planned then. In the shuttle program, it turned out that costs for this are much higher than for new rocket parts. Nevertheless, the ESA is conducting further studies. It is possible that traditional types of expendable rockets will soon encounter acceptance problems for reasons of environmental protection.

### ESA: Construction of Ariane Transfer Vehicle Planned

92WS0200D Stuttgart FLUG REVUE in German  
Dec 91 pp 26-27

[Text]

### Cargo Ship to the Space Station

The problem of transportation for supplying a permanently manned space station still cannot be solved satisfactorily. There are too many demands on the American shuttle fleet. An unmanned cargo container for the Ariane rocket could help.

Experts have calculated that, despite reductions in the US space station Freedom, five shuttle missions per year will be necessary even after construction. These supply flights will bring replacement parts, fuel, and other commodities as well as new experiments. While for the time being the space shuttle is the only solution for the exchange of crews, these missions can also be undertaken by unmanned transport vehicles. Since the European Space Agency [ESA] with its Columbus Module, which docks with Freedom, is also affected, it is planning remedial action.

Two different cargo containers were being studied by the companies Aerospatiale and British Aerospace. They could be brought en route to the space station by the Ariane-5 rocket or else by foreign vehicles like Titan-4 or the Japanese H-2. The companies oriented themselves towards the current capacity of the Ariane-5, which is stated as 23 t for the low orbit. In case thrust power for the Hermes space plane is increased, the transfer vehicle could weigh 25 t.

The first design is based on technology which is being developed anyway for the Ariane-5. Both the upper stage as well as the equipment bay, which is outfitted with control electronics, are used for the cargo ship. NASA specifications must be taken into consideration for the propulsion system. Thus, for reasons of safety, only a cold gas system may be chosen for the final approach to the space station. Fuel accounts for about 2.8 t of the

ATV's weight. But about 16 t of cargo could still be delivered to the space station by the fueled 7 t equipment.

The second design looks even better. Here Ariane-5 components are dispensed with and instead a container is designed which can be handled like a satellite. In comparison with the competing design, this allows about 900 kg more material to be brought to the space station.

If the ESA decides to begin development of the Ariane Transfer Vehicle soon, the equipment could be available in the second half of the 90s.

### German-Dutch Wind Tunnel Tests Airbus Prototypes

92WS0206A Stuttgart FLUG REVUE in German  
Dec 91 pp 63-65

[Article by Goetz Wange: "Research: DNW Simulates Aerodynamics Down to Last Detail: Tunnel Project"]

[Text] The twin-jet, long-range A330 Airbus will have its first flight in a few months. At the present time a model of the Airbus is being thoroughly tested in the biggest wind tunnel in Europe. The chief objective: How is the flap system on the wing affected by the jet stream from the engine?—a difficult simulation.

Right now, the Japanese are getting into the act. German-Dutch Wind Tunnel (DNW) is expected to serve as sponsor when an even bigger and more expensive version of Europe's biggest testing facility is built in the Far East. It is expected to go into operation for the ambitious project of a new supersonic commercial aircraft. But the project is not yet that far advanced by a long shot. Hans-Ulrich Meier, the manager of the testing facility founded 15 years ago by the Dutch Aerospace Research Institute (NLR) and its German counterpart, the DLR [German Aerospace Research Institute], does not want to waive the rights to its know-how without a profit. But they are naturally flattered by the Asians' interest. "We're first in the world in our field, which is why no one can take us in so easily," he emphasized, alluding to the team spirit of the experts assembled in Noordoostpolder, not far from the town of Emmeloord.

How important preliminary work on aerodynamics is to new aircraft projects is made clear by the problems encountered during the introduction of the new McDonnell Douglas trijet MD-11. For the newcomer to be able to provide the performances guaranteed the airlines, it has to be further improved while it is still being introduced into the market. Even the lengthening of the wings was open to discussion. This is expensive and does not exactly promote confidence among customers. DNW manager Meier evinced sympathy for his American colleagues, but did not conceal his satisfaction either: "For a long time they thought that they could leave everything to the computer. But that works only to a limited extent. Certain things simply have to be tested in the wind tunnel."

In fact, DNW has received something like a subsequent confirmation through developments in the United States. Since the big aircraft manufacturers, with Boeing leading all of them, are at present building their own wind tunnels for the low-speed range.

However, with respect to earlier years, the focus has changed. The chief objective is no longer a generous, very attractive passenger flight configuration, but the takeoff and landing phases. Since the function of the lift systems of the wings is just as decisive a factor in determining how many passengers will be carried later or how much baggage may be stowed. The effect of the jet stream from the engines on the flaps, which are designed to increase lift, plays an important role in this.

"This is one of our specialties," noted Hans von Ditshuizen, responsible for marketing and planning in the DNW management team. Naturally, engine simulations in aerodynamic measurements was not invented there. This is also found elsewhere. Nevertheless, within a 9.5 by 9.5-meter measurement space they can work with models which, because of their appropriate size, are very faithful to details. With the A330/A340 Airbus program, for example, the wind-tunnel model built by German Airbus on a scale of 1:10 after all attains a length of 6 meters, and the wingspan is only slightly less than that: an investment of about DM5 million. One peculiarity: The flaps can be remote-controlled. And operational engines are installed where in other wind tunnels only flow-through nacelles are suspended. However, no fuel is burned in the wind tunnel; instead compressed air is used to drive the model engines—each of which is worth about DM600,000.

The chief objective lies in a study of the second phase of flight during climb. This is especially important for the licensing of a new model since, in an emergency situation, takeoff may no longer be aborted. The simulation of an engine failure in this risky situation is part of the standard program for the Airbus at DNW.

#### Even the Bottom of the Wind Tunnel Can Be Moved

The measurements for the landing phase are also particularly expensive. Aerospatiale [National Industrial Aerospace Company] has further refined the engine model for this. Even the sliding reversal system can be driven out. In this way, for example, it was determined that the warm exhaust gas from the engine is reabsorbed under certain conditions and this has a negative effect on the braking action. This could be corrected before it resulted in high repair expenses in later use. The brakes would have had to be replaced frequently and airline compensation claims were to be anticipated.

And to see to it that everything also happens as it does in a real situation, another DNW specialty is employed: In the area of the touchdown point a roller system makes the ground rush by under the aircraft model as in a real landing or takeoff.

DNW is also a sought-after partner in connection with the preparation of the next Airbus generation. They expect to develop a jumbo competitor with a maximum capacity of 750 passengers. For this the trend is toward engines with increasingly greater diameter. They should be more economical than their predecessors and consume far less fuel than the latter. "However, about 50 percent of the power will be swallowed up by the greater air resistance of the huge engines," DNW manager Hans-Ulrich Meier gave us something to think about. No one yet knows how much will actually be [lost]. It is up to Europe's biggest wind tunnel to find out how much. The first basic tests should begin as early as next year. They will be funded by the European Community in connection with BRITE/EURAM [Basic Research in Industrial Technologies for Europe/Research Program on Raw and Improved Materials]. The goal is to build up an initial data base on the effects of installation.

The measurements made at DNW have long since become indispensable for the Airbus industry. Even though measurements at DNW cost about DM50,000 to DM70,000 a day, they are expert at engine simulations. The money is well spent, especially since the data for the Airbus family are better today than ever. Since, when development of the family was begun, an extensive free-flight program was conducted with the A300 to verify the DNW data. Comparison of the values obtained is also today of benefit in the wind-tunnel tests for the A330 and A340 versions. The more confidence was gained in the results of the measurements, the fewer test flights had to be made. And they would have been 10 times (per hour) as expensive as the cost of using the tunnel at DNW. To say nothing of the unpleasant surprises which can now be cleared up in the early phases.

#### MBB Test Platform to Evaluate Aircraft Electromagnetic Compatibility

92WS0206B Stuttgart FLUG REVUE in German  
Dec 91 p 87

[Article by V. Leuschner: "Interference Tests on Wooden Platform"; first paragraph is FLUG REVUE introduction]

[Text] With a device that is unique in the Western world, MBB [Messerschmitt-Bolkow-Blohm] in Manching can test aircraft electromagnetic compatibility (EMC).

While a few years ago aircraft were still only mechanically controlled, in the fly-by-wire age electrical impulses and on-board computers have taken over this task. Since aircraft are not perfect Faraday cages, they act like big flying antennas. Thus, high-frequency electromagnetic waves can penetrate the interior of the aircraft and then induce currents in the electronic system and sometimes cause failures of control instruments, the power system, and other critical components. Not even quadruply redundant systems are proof against such disturbances since they simultaneously affect all components. During

construction of the Tornado and the problems linked with it, there was a loud demand for a testing device to prove the EMC of the original version of the aircraft. In order to be able to study both radiation directions, vertical and horizontal, that occur in real situations, MBB erected a device costing about DM10 million on two test platforms. With one platform on the ground, the effect of polarized vertical fields on aircraft 40 meters long and with a wingspan of up to 35 meters can be studied. On the second device the aircraft's immunity to polarized horizontal waves is tested. To accomplish this, aircraft with a wingspan of 15 meters and weighing up to 30 tons are raised on a 20-meter-high, revolving platform whose height is adjustable and thereby optimally radiated. With this setup, the antenna systems can produce any imaginable form of signal within a frequency range of 5 to 30 megahertz. Since the aircraft can be brought very close to the radiation source, only one-fiftieth of the output of an average transmitter suffices to produce stronger fields than occur in normal flight operations.

Nearly all important flight conditions can be simulated during the test. While this is going on, the pilots in the cockpit check out all relevant functions. In addition, specially developed sensors transmit all important data to the control center, from which the functions of the aircraft and the testing device are monitored and controlled. To do this, all additionally built-in instruments and sensors must themselves be immune to electromagnetic waves and must not interfere with the field produced by the testing device. This is why the transmission of data from and to the control center is exclusively effected over optical fiber cable. Also, no metal must be used in the construction of the testing platforms. A special plywood, low in water content, and kevlar cable are the chief building materials.

How strongly the internal signals are influenced by the interfering field, independent of frequency, field strength, and direction, is evident from the EMC profile of the aircraft that has been determined. Thus, the manufacturer can ascertain which of his components are in keeping with international specifications and which of them must still be improved. Through tests repeated at regular intervals, changes in the shielding can be verified since an intact structure is far from being a guarantee of radiation safety. Its protective efficacy can be reduced by corrosion.

Its chief customer in the immediate future will be the military equipment industry since the device is of a size that is made-to-order for fighter aircraft. Since the fly-by-wire technology has also taken hold with civil aircraft, MBB hopes in the long run to receive orders from manufacturers of commercial aircraft. Aircraft of this size can be measured on the vertical device.

#### **Swiss Develop Coatings for Horizontal-Launch Spacecraft**

92MI0212 Bonn *TECHNOLOGIE-NACHRICHTEN*  
*MANAGEMENT-INFORMATIONEN* in German  
18 Dec 91 pp 24-25

[Text] Vertical take-off means that modern space vehicles like the American Discovery and the Soviet Burane

require very powerful rocket engines and costly launching facilities.

However, new systems are being developed that will allow space vehicles to take off and land horizontally. This could reduce energy consumption and operating costs, although these systems are subjected to very high structural, mechanical, and thermal stresses.

The European Space Agency (ESA) has commissioned Battelle in Geneva and Dornier GmbH/German Aerospace to undertake a two year project to analyze new materials that might be capable of withstanding the stresses inherent in horizontal space flight.

The study will focus on materials that can be used to build a two-stage space vehicle, for example Saenger II. A vehicle of this type takes off horizontally, shedding a second module at a very high altitude. The module goes into orbit and eventually lands again on earth. The space vehicle itself flies back and lands like a normal plane.

During flight and when shedding the second stage, some parts of the space vehicle are exposed for many hours to temperatures ranging from 600° to 1,000°.

Dornier GmbH/German Aerospace has suggested various materials that ought to withstand such high temperatures for assessment. They include titanium alloys resistant to temperatures up to 600° and SiC/SiC ceramic composites resistant up to 1,000°.

Battelle in Geneva is currently developing coating techniques for these materials and testing them under realistic conditions (high temperature, mechanical and thermal fatigue, static and cyclic stresses, and so on).

These systems, which are produced by CVD (chemical vapor deposition), are suited to ceramic and metallic materials, and they are also oxidation and temperature resistant. Tests are currently being carried out by Battelle in Geneva, and the results will contribute to the further development of future space transport systems.

#### **French Official Requests Parliamentary Debate on Space Program's Future**

92WS0216B Paris *LE MONDE* in French 11 Dec 91  
p 16

[Article by Jean-Francois Augereau: "In a Report From the Office for the Evaluation of Scientific and Technological Choices, a Parliamentary Debate on the Future of the Space Policy Is Requested"—first paragraph is *LE MONDE* introduction]

[Text] A "weighty orientation (...) was adopted a few years back and regularly confirmed, without any explicit debate taking place in Parliament," according to a report on the future of the French and European space policy presented on Friday, 6 December by the Parliamentary Office for the Evaluation of Scientific and Technological Choices. Its author, Socialist Senator Mr. Paul Loridant, believes that "Parliament should not be reduced to voting large and increasing budget credits every year without giving its opinion on such weighty choices."

In recent years, it is true, France and Europe have launched an ambitious space program, the best results of which are Ariane Meteosat, Spot, Spacelab, or the 51-G shuttle mission for manned flights. Today, the European space program has reached a turning point, and choices are becoming more difficult.

Some are obvious, like the continuation of launcher and satellite development. Others less so, for technical and budget reasons; e.g. launching European astronauts into space. This was also demonstrated at the recent inter-ministerial space conference in Munich. Under these conditions, it is not unusual for the Parliamentary Office for the Evaluation of Scientific and Technological Choices<sup>1</sup> to consider the question and call for a debate in parliament. The intention is noble, and the voluminous appendices that accompany Senator Loridant's report are full of judicious remarks. However, one cannot fail to question the reasons, supposedly "technical," that caused this report on the French space policy to be presented after, rather than before, the Munich inter-ministerial conference. Even the Academy of Sciences, which cannot be suspected of revolutionary tendencies, did not make that mistake: it proclaimed its opinion loud and clear one week before the Munich conference.

Let us hope that such a mistake will not be repeated, so that the true parliamentary debate on the French space policy that Mr. Paul Loridant demands can take place under the best possible conditions. However, before it starts, the Essonne senator, while acknowledging that "Europe's technological competitiveness in space is satisfactory," is asking parliament members to ponder a few points already emphasized by other bodies, for instance the Academy of Sciences.

#### **For a Programming Law**

One of Mr. Loridant's main concerns is obviously the debate on man's presence in space. "The choice of manned flight systems for all components (Ariane-5, Hermes, Columbus, DRS [data-relay satellites]), is the result," he said, "of a political choice (...). The other justifications seem to be of secondary importance (...). The cost is high, but not unreasonable (...) and should not throw back into question the other space activities." In particular as far as Earth observation, the sciences of the universe, and their applications are concerned.

The Essonne senator also emphasized the need to strengthen "our achievements in the space telecommunications industry" and to make "a considerable strategic reflection and R&D effort" to prepare the next satellite generations. In this respect, he observed, "our industry remains too disseminated," and it would be a good idea to make an "assessment" of the policy of the European Space Agency, which is unable "to carry out a true industrial policy" in this field.

Finally, Mr. Loridant called for a broad reflection on the military space program, "a component indissociable from the space policy." This sector, he said, must acquire a European dimension "so Europe can rank as a first-rate power" and broaden its reflection on the subject to include themes concerning antimissile weapons and satellite-based positioning and localization systems like those used during the Gulf War. For all these reasons, we should consider "preparing a space programming law" that would ensure compliance with most of these objectives.

#### **Footnotes**

1. "The Orientations of the European Space Program": provisional report from the Parliamentary Office for the Evaluation of Scientific and Technological Choices.

#### **Aerospatiale's Airbus, Helicopter Programs Discussed**

##### **Cutbacks Planned**

92WS0226A Paris LA TRIBUNE DE L'EXPANSION  
in French 28 Nov 91 p 10

[Article by Hubert Levet: "Aerospatiale Production Plan Cutbacks Being Studied"; first paragraph is LA TRIBUNE DE L'EXPANSION introduction]

[Text] Aerospatiale has prepared several plans for cutting back its production capacity, including a very severe one that Jean Pierson has not unveiled publicly. The French aircraft manufacturer is being affected by the upheavals in the world economic situation.

In announcing, the day before yesterday, a slowing in the production rate of the Airbus product line's crown jewels (LA TRIBUNE, 27 November), Jean Pierson, managing director of the consortium, was but revealing a secret that has long circulated around the Toulouse tarmac, seat of Aerospatiale's Planes Division. The uncertainties reigning over the aeronautics industry worldwide could not fail to affect the French builder. According to information gathered by LA TRIBUNE, the production plan cutbacks are severe. But in reducing this cutback, undoubtedly out of fear of running out of planes in the event of a turnaround of the air transport sector, Jean Pierson clearly wanted to force the hand of the industrial consortium partners, the strongest advocates of round-the-clock operations. The fact remains that, at Aerospatiale, where the preliminary drafts of the intermediate-term plans [ITP's] of the group's divisions are

circulating, it is staunchly pointed out that the question of production output rates is for the Airbus GIE [economic interest group] industrial partners to decide.

### 38 A-310's in Lieu of 52

The first to be affected by this cascade of "wrenching revisions" is the A-310: Aerospatiale plans to produce only 38 of these between 1993 and 1995, in lieu of the 52 announced at the start of 1991 and in spite of the probable forthcoming announcement of the launching of a new "cargo" version of this plane for Middle Eastern clients.

The same goes for the A-320 and A-321. The output rate of the first of these is to be "slipped" during the mentioned period, while the ITP of the second is being slashed outright. In due time, should the present situation continue unabated, consideration might again be given to concentrating the final assembly lines of these two planes at a single site, at Deutsche Airbus's Hamburg complex.

All of this would be a lesser evil if the "gaps" in the Planes Division's 1993-1995 production schedule could be "bridged" by the new A-330 and A-340 programs. The A-330 appears to be fulfilling its promise, but 10 planes are being slashed from the production schedule of the Toulouse A-340 assembly lines for the period.

The approach is identical with respect to the ATR GIE's "commuters": 46 ATR-42's and ATR-72's will not be produced between 1993 and 1995.

Equally affected by the general "melancholy" of production cutbacks is Aerospatiale's nevertheless profitable Helicopters Division, which is to be spun off to form the subsidiary Eurocopter GIE, together with its trans-Rhine counterpart in the MBB group, effective this January. In the wake of a cutback in military contracts for its big revenue producers—the Super-Puma and the Dauphin—this Division, which will have a cash flow of 540 million francs[Fr] in 1991, has seen its projected-orders outlook drop from Fr13.25 billion as of 30 December 1990 to Fr10.72 billion as of 30 September of the current year. The French branch still does not have reason to be unduly worried about the intermediate term, however, since, little by little, it is renewing its business with new programs like the P120, a small 2-seat helicopter; the NH90, which is to replace the Super-Puma; the Tigre combat helicopter; and the retrofitting of the Super-Puma and Dauphin with new power plants. Brought round to the rigors of the situation, Aerospatiale's industrial divisions (Planes, Helicopters, but also Missiles, and Strategic and Space Systems) are its backbone, and should the situation demand it, Boulevard de Montmorency, Aerospatiale's head office in Paris, makes it abundantly clear that it can adapt still further.

[Box]

### THE HELICOPTERS DIVISION IS AFFECTED...

#### Helicopter Programs—Annual Quantities (First Flight)

	1990	1991	1992		1993		1994		1995	
	Helico Div(1)	Group Hq(2)	Helico Div	Group Hq	Helico Div	Group Hq	Helico Div	Group Hq	Helico Div	Group Hq
Dauphin 365-366	53	49	51	20	50	25	46	25	41	25
Ecureuil 350	142	170	195	149	160	150	160	150	160	150
Ecureuil 355	38	37	65	45	60	40	60	40	60	40
Gazelle 342	7	3	9	0	12	0	10	0	9	0
Super-Puma 332	42	36	36	30	36	36	36	36	36	36

Source: DCI/AS

(1) Helicopters Division: Figures compiled by the Division

(2) Group Headquarters: Preliminary corrections by the Group General Management

### Helicopter Programs

The cutback in production programs is not unduly worrying Eurocopter's French branch, and the less so in that the American competition, particularly with respect to civil aviation projects, is in the same boat. Value-added production represented 33.7 percent of total production in 1990, versus 38.5 percent in 1989. This downturn follows the same curve as that for all the

group's divisions, whose value-added production in the aggregate dropped from 34 percent in 1989 to 30.1 percent in 1990. With a manufacturing program amounting to approximately 1,500 helicopters over a period of 15 years, for an average of 100 helicopters a year, the NH90, Eurocopter's share of which is 67.8 percent, will assure the Helicopters Division of a smooth "tide-over." Concerned by this program are 4,600 Aerospatiale employees and 9,600 subcontractors.

... AS IS THE PLANES DIVISION

Plane Programs—Annual Quantities (First Flight)

	1990	1991	1992		1993		1994		1995	
			Planes Div(1)	Group Hq(2)	Planes Div	Group Hq	Planes Div	Group Hq	Planes Div	Group Hq
<b>Airbus large transport planes:</b>										
A 300-600	21	23	25		27		24		25	
A 310	17	26	20		12		16	13	15	13
A 320Dt develop	0	0	2		6	9	42	39	48	45
A 340Dt develop		1	10	7	47	43	32	31	32	30
<b>Airbus small transport planes:</b>										
A 320	64	126	107	108	93	104	84	76	63	57
A 321 start P 40 (wings, fuselage assembly)			3	2	9	6	29	34	47	53
<b>Subcontracting for Dassault Aviation:</b>										
ATL 2	3	3	3		3		3		3	
F 50	11	11		11		11		6		
Mirage 2000	42	25	25		25		25		25	
<b>ATR:</b>										
ATR 42	36	32	31		34	31	28	22	30	16
ATR 72	16	27	35		39	35	54	44	59	50

Source: DCI/AS

(1) Planes Division: Figures compiled by the Division

(2) Group Headquarters: Preliminary corrections by the Group General Management

**Planes Programs**

The final recasting of the Planes Division's ITP will become known around the beginning of next year. Between now and then, Aerospatiale's Marketing and Industrial Management will manage to find a modus vivendi based on these figures. Concerning its subcontracting activities for Dassault Aviation—such as the ATL2 and the Mirage 2000—the 1993, 1994, and 1995 program remains subject to the Military Planning Law that is to be voted on this coming spring.

**[Box]**

**Henry Martre Confirms Negotiations With Japan**

In the wake of Airbus Managing Director Jean Pierson's reference to the idea of a cooperation with Japanese industrialists, Henri Martre, the Aerospatiale Group's president, confirmed yesterday that he is conducting negotiations with Kawasaki, Fuji, and Mitsubishi to help these enterprises supply helicopters to the Japanese Armed Forces.

Henri Martre, however, made it clear that these negotiations cannot be expected to come to a conclusion in the

immediate future, and that they do not involve selling finished products to Japan. Aerospatiale is already the leading exporter of helicopters to Japan.

**Market Analyzed**

92WS0226B Paris *LA TRIBUNE DE L'EXPANSION*  
in French 28 Nov 91 p 10

[Article by Hubert Levet: "Airbus' 'Roving Planes'"]

[Text] By totaling up the string of announced contracts, one ends up with a distorted image of the real status of the Airbus order book. A closer look reveals that even the principals involved seem at times to get lost in the maze. As of September, Airbus still counted on 135 orders to the end of the year. Today it can account for only 91 sales, including all planes in its product line and all sales made between 1 January and 31 October 1991. But for the same period, Aerospatiale shows only 70 planes sold: 40 A-300-600, 1 A-320, 3 A-321, 5 A-330, and 21 A-340. It also shows 2 A-310 cancellations.

Why such a gap? Apparently, Airbus and Aerospatiale do not use the same criteria to define the term "order." The European consortium simply adds up the clients' letters of intent. The French manufacturer, on the other hand,

does not consider an order a firm one until the client has deposited the first installment, usually in the amount of around \$100,000.

Curiously, this version, though more realistic, has never been used by the consortium in its presentations and releases. The failure of Airbus' figures to square with those supplied by Aerospatiale has even confounded the employees concerned.

Visibility with regard to the order books has been rendered all the more fuzzy these last few months as disappointments being encountered by most of the world-class airlines have compelled them to terminate contracts. Overall, Airbus has succeeded in finding homes for the planes originally built for companies that have gone bankrupt, such as Pan Am and the Slovene company Adria Airways. Mainly they have been placed with the Orix Corp (Japan), Mexicana, and Ecuatoriana airline companies.

Stored for the moment at Aerospatiale's Toulouse plants are three A-320's for Royal Jordanian: Numbers 123, 182, and 185.

#### **ESA, Matra to Develop Laser Communication System**

*92WS0235B Paris AFP SCIENCES in French 5 Dec 91 pp 14, 15*

[Text] Paris—On 3 December, the firm Matra Marconi Space (Matra group) and the European Space Agency (ESA) signed a 600-million-franc contract for the development of a satellite optical communication system, according to a Matra press release.

Dubbed Silex (Semiconductor Laser Intersatellite Link Experiment), the system will make it possible to establish a direct link between the Spot-4 remote sensing satellite and ESA's Artemis (Technology Mission Satellite), two satellites which will be placed in orbit in 1994 and 1995, respectively.

Silex will enable the first *in situ* testing of a new high-speed laser communications technology, performed here on relay links between a low-orbit satellite or module at an altitude of 400 to 500 km (in this case, Spot, although future tests will involve the polar platform provided by the Columbus modules) and a geostationary satellite 36,000 km from earth (Artemis). A link with an optical terminal on the ground is also planned.

Matra did the feasibility studies for this intersatellite laser communications program in 1983-1984. Three years later, the firm was named prime contractor for the Silex system in the context of an ESA mission, DRTM (Data Relay Technology Mission).

#### **New Saab 2000 Regional Aircraft Unveiled**

*92WS0249A Stockholm DAGENS NYHETER in Swedish 14 Dec 91 p 33*

[Article by Lars Dahl: "Saab's Hope Rolls Out to Meet an Uncertain Future"]

[Text] Today, Saturday, a new Swedish commercial airplane is rolling out in public, displaying all its external splendor against a background of music and champagne.

Saab is holding a so-called "roll out" in Linköping for the Saab 2000, a plane with room for 50-58 passengers. The current price is around 75 million kronor per plane.

It is the third commercial aircraft in the company's history—a few people may recall the Saab Scandia from the 1950's. There is still one left in Brazil.

Airplane number two was the better-known 340. Incidentally a big order for the 340 is being announced in Linköping today.

"Rolling out," emerging from the inner recesses of the plant, is a big event for an aircraft and especially for its manufacturers, an event that is regarded as justifying a real celebration attended by the king and queen and guests from around the world. This is good for the firm's image and hopefully for sales as well.

#### **Ready to Fly by Fall 1993**

Around 1,500 test flight hours lie ahead for the airplane making its debut today and the next two off the line. Not until then, toward the fall of 1993, will the guardians of flight safety, the aviation authorities, have enough accumulated data to give their seal of approval and sign a certificate of airworthiness.

The Saab 2000 was developed under the supervision of 12 European aviation authorities and the American FAA, the Federal Aviation Administration.

The plane is rolling out in the December chill but the commercial temperature is quite hot, in other words competition among the world's airplane manufacturers is tough. There are many who like Saab are trying to capture the niche that encompasses regional and feeder service.

The battle is for a market that is not really as gilt-edged as it was when the various projects were started in the good years of the 1980's. Now we have a recession, the effects of war and uncertainty about what things will really be like in 1993 when the long-discussed deregulation or liberalization in Europe is upon us.

No one knows for certain how free and fair the free competition will be. Ask Jan Carlzon of SAS. He is worried and would like to know.

### Great Uncertainty

The uncertainty makes it hard to say what kind of market there will be for the Saab 2000 and its competitors and what the financial condition of the airlines will look like when the bills have to be paid. In addition there are divided opinions in the regional and feeder area about which is a better bet, jet engines or turboprops. Saab is banking on the turboprop and promises a cruising speed of 675 km an hour.

According to the latest reports the situation is not really as gloomy for regional and feeder companies as it currently is for major airlines. In the first half of the year Europe actually noted a 7 percent increase in the number of passengers.

Saab is obviously in a good position with its 2000. According to the company's own assessment it has "an excellent starting position," while a neutral expert more cautiously described it as "a starting position that is no worse than it is for other manufacturers."

Saab currently has 46 firm orders for the 2000 and 146 options, distributed among airlines around the world, from Sweden via Switzerland, France and England to the United States, Australia and the Marshall Islands in the Pacific.

"A considerably better situation than we had when we unveiled the 340," a Saab spokesman said.

There is no reliable information about how many airplanes must be sold before the 2000 production starts to show a profit. The total development cost was reportedly 2.7 billion kronor.

Five years after the first delivery—which will be made in September 1993—the aircraft should start to show a profit. That is Saab's answer for now. Whether this means 150 plane sales or 200 or 250 is an open question.

Of course the Saab 2000 is an entirely new airplane that incorporates all the latest aeronautical and electronic innovations. At the same time it is correct to say that the aircraft is an extended version of its predecessor, the 340, the body has the same transverse dimension, for example. A great many other things, primarily in the cabin, but also quite a few in the cockpit, are the same in the two airplanes. This means big production dividends just as it means dividends and other advantages for companies that currently own the 340 and decide to continue their expansion plans with the Saab 2000.

And there are plenty of satisfied 340 customers. Around 270 of the 340 series have been delivered and are in service today on all five continents. In addition the company has 70 firm orders moving through the factory and an undisclosed number of options.

### Selling Well

There is no denying that the Saab 340 is selling well. The aircraft has gained a foothold in a large number of

strategically important markets, including China—a country that is just starting to build up regional airlines and route networks.

Thanks to the 340, Saab has also achieved a 50-50 division between civil and military aircraft production. The civil side even has a small edge just now.

Saab's next move may be a plane for 70-80 passengers. A plane in this class is being studied. If they decide to go ahead it will be an entirely new plane from top to bottom. The laws of aerodynamics prohibit an extension of the Saab 2000.

### European Space Telecommunications Found Lagging

92WS0256A Paris AFP SCIENCES in French  
12 Dec 91 p 8

[Article: "Europe's Competitiveness in Telecommunications Satellites 'Not All One Could Wish'"]

[Text] Paris—European space technology's competitiveness is "globally satisfactory, but its commercial competitiveness in telecommunications satellites leaves something to be desired," according to a recently published report by the Parliamentary Office of Evaluation of Scientific and Technical Options. This is the first report of Parliamentary origin to be devoted to the future of French and European space policy. It was presented to the Senate on 6 December by Senator Paul Lorient.

The report deems TV receiving equipment and commercial network terminals to be European space technology's weakest points. It finds European know-how in the telecommunications industry seemingly "fragile" opposite that of the Americans and Japanese, and points out that, generally speaking, competition can be expected to intensify in the coming years.

Citing vying ambitions with respect to hypersonic plane projects, and the difficulties that prevent the ESA [European Space Agency] from conducting "a real industrial policy," the Office fears a fragmentation of space-age Europe and a dispersion of its outlays.

### France: Novespace's First Five Years Assessed

92WS0256B Paris AFP SCIENCES in French  
12 Dec 91 pp 9, 10

[Article: "Novespace: 5 Years of Promoting Space Technologies Among the Industries"]

[Text] Paris—In his report, released in Paris on 10 December, on the first five years of operation by Novespace, a corporation specializing in space technology transfers, its chief executive officer, Jean-Pierre Fouquet, cited Novespace's listing of some 300 space-generated technologies that are transferable to "terrestrial" industries, and of some 3,500 small and medium-sized French enterprises potentially concerned with space technologies.

Novespace was founded in July 1986 under the aegis of the CNES [National Center for Space Studies] to further these transfers and promote the industrial use of micro-gravity. To this end, Novespace was designated to operate the Zero G Caravelle used by the CNES, the CEV [Flight Test Center], and the DGA [General Delegation for Weapons] for parabolic flights, during which on-board conditions of weightlessness comparable to those of a space vehicle in orbit exist for a duration of 20 to 25 seconds.

These flights make it possible to conduct many diverse tests ranging from the final checking of equipment that is to be sent into space to studies of solid-liquid interactions and the forming of improved polymeric structures for use in the biomedical field. Included in this range are studies of the dynamic of combustion, the forming of quasi homogeneous alloys that are unrealizable on Earth, to say nothing, of course, of studies of the different factors involved in the adaptation of human beings to the absence of gravity.

In five years, Novespace has completed a dozen or so technology transfers. Another dozen or so are currently under negotiation. "That may seem like very few, but it must not be forgotten that it takes all of several years to complete a technology transfer," Mr. Fouquet pointed out, citing the case of a water purifier stemming from a device that was used aboard the Skylab space station in 1973, and only recently commercialized in the United States.

The transfers realized by Novespace have often given unexpected and spectacular results. A case in point is the boom with the retractable structure: It recoils on the flat, into the form of a retracted tape measure. When it is uncoiled, it automatically adjusts itself to form a tube, at the end of which a camera or an instrument can be attached and so introduced into an environment, that is difficult to access or hazardous. Applications in the nuclear field are already being contemplated.

Other examples are: A partially implantable artificial ear, and a "pill" capable of telemetering the body's internal temperature, both derived from space micro-electronics; fireproof felts that are an outgrowth of the Ariane program; a machine for freeze-clamping small pieces to be machined; and software packages developed for space missions and applicable to the operation of oil-drilling platforms.

Novespace has published seven issues of its MUTATIONS catalog and distributed 20,000 copies of each for use by industries. In addition, it has brought out the first issue of its TEST [Transferable European Space Technologies] catalog, which is published in five languages, and distributed 30,000 copies of it to the ESA [European Space Agency] member countries. Novespace has also created Spacelink Europe, a European network, to better organize the transfer of space-related technologies. This GIE [economic interest group] concerned consists of Novespace, JRA (Great Britain), and MST (Germany).

Another high-technologies network has been formed under the EEC's SPRINT program.

Novespace, which employs 10 persons full-time and has a capital of 5 million francs[FR], expects to have earnings of Fr14.7 million in 1991. Forty-eight percent of its capital shares are owned by CNES, another 48 percent by a pool of eight banks, and the remaining 4 percent by ANVAR [National Agency for the Development and Commercialization of Research].

### Spain: CASA's Strategy, Search for Partners Detailed

92WS0266 Duesseldorf *HANDELSBLATT* in German  
7 Jan 92 p 11

[Unattributed article: "Spaniards Seek Closer Ties to MBB; Negotiations on Increased Investment by the DASA Subsidiary and the Withdrawal of INI Progressing at an Extremely Slow Pace"]

[Text] The leading Spanish aeronautical enterprise is Spanish Aeronautical Engineering Company (CASA), of Madrid. Over the next few months this enterprise, which is controlled by the state holding INI [Instituto Nacional de Industria], must make a decision concerning its strategy for the future. Some of the issues to be considered include the withdrawal of INI in favor of private partners, the augmentation of CASA's limited capital, and the pursuance of new, independent projects.

The junior partner in the Airbus and Fighter 90 program, which has only one private shareholder—the German DASA subsidiary MBB, with 3.6 percent—does not consider itself capable of surviving the increasing global competition without partners. Consequently, in 1991, CASA began the search for a foreign partner which would, if possible, assume as much as 33 percent of the corporate stock.

Although the Madrid Ministry of Industry insists that controlling interest in the enterprise remain under Spanish control, it is willing to approve a reduction of the INI share from the current 96.4 percent to less than 50 percent. As a result, private Spanish shareholders are being sought to act as the third partner. Enterprises under consideration include the Banco Bilbao-Vizcaya, the Basque banking giant, and Iberdrola, the leading electrical company.

MBB is still the only foreign partner in sight. Because the Munich firm did not participate in the last capital increase, its CASA share was recently reduced from 11 percent to the current 3.6 percent. Because no other potential partners have come forward, the Germans are convinced that CASA and MBB will come to an agreement sometime in the next few months concerning a larger share.

Nonetheless, the negotiations, which began in December and are to be resumed in February, are apparently

progressing at an extremely slow pace. The Germans, according to Madrid, are only interested in a partnership if CASA becomes a private enterprise. As mentioned above, however, the necessary Spanish privatization partner has not emerged. And INI will only award MBB the contract if the "industrial program" is to its taste, i.e., if CASA remains an independent enterprise and is not turned into a mere branch of or workbench for MBB.

Aeronautics expert Erich Riedl (Christian Social Union (CSU)), parliamentary state secretary of the Bonn Ministry of Economics, indicated a few days ago that he had been impressed by CASA's modern factories and plans for the future. In conversations with both CASA and representatives of the Madrid Ministry of Industry, Riedl openly advocated closer German-Spanish cooperation within the aeronautics industry. His visit to Madrid, in the company of leading DASA managers, was also regarded as an attempt by Bonn to revive the stalled negotiations between CASA and MBB.

Riedl particularly urged CASA to participate directly in the development and construction of the planned 100-seat short-range airplane. The only firms presently involved in the project are DASA, Aerospatiale (France), and Alenia (Italy). Riedl told the *HANDELSBLATT* that the project will not be truly "European" if the Spanish do not also participate.

Another reason that Bonn considers increased integration within European aeronautics projects and the participation of CASA in the Airbus Project important is that CASA, by accepting orders from direct competitors of the Airbus, is attempting to exhaust production capacity. In the opinion of Riedl, CASA participation in the Airbus Project could be further augmented: Whereas the underwriting participation is 4.2 percent, the Spanish-added valuation in the Airbus has thus far been only 3 percent.

During his visit to Madrid, Riedl stated bluntly that the other partners in the Airbus project "distrust" CASA because the enterprise supplies the horizontal stabilizer for the MD 11, which is in competition with the A340, as well as components for B727s and B757s. Furthermore, CASA bid for the contract to manufacture the airfoils for the MD-12. However, the Taiwan-strategy of McDonnell-Douglas could dry up CASA's source of American orders, which is one more reason for the Spanish enterprise to keep an eye out for new European projects.

CASA spokesmen repeatedly stress, however, that they do not believe that the future of the enterprise lies in merely acting as a subcontractor or junior partner in international programs. Even today, the development and manufacture of its own products is a mainstay of the seven-plant enterprise. The two most important products are small turboprop airplanes with both military and civilian applications. The first is the 26-seat C-212, just under 500 of which have thus far been sold. The second is the newer 44-seat C-235, nearly 200 of which have been sold world-wide.

An additional project is in the preparation stage. During its final session of 1991, the Spanish government granted CASA a special credit equal to 32.9 billion pesetas [Pta] (approximately 518 million German marks [DM]) with which to develop the C-3000 by the year 1998. The ultramodern turboprop of this 70-seater, which is to compete with the ATR-72 planned by the French and Italians, is expected to provide the aircraft with an average speed of 660 km/h and a range of 1,800 km.

However, the realization of this as well as other ambitious plans for the future depends on whether CASA receives its badly-needed financial shot in the arm in the near future. At present, its common stock is equal to Pta16.2 billion (approximately DM255 million). If CASA, which has been in the red for years, is to eliminate its constant shortage of liquidity and become a world competitor, its common stock will have to be increased by approximately Pta50 billion. In addition, it is essential to complete the personnel reductions, two rounds of which have already taken place. At least 1,000 of the 10,000 total employees should be laid off in the following months.

There are, as of yet, no final figures on how CASA, which is export-oriented and therefore suffering from the strong peseta, performed during 1991. During the first 10 months, its losses increased to Pta7.5 billion (approximately DM119 million) in contrast to Pta4.5 billion during all of 1990. Sales amounted to Pta68.5 billion (approximately DM1.1 billion), and the gross debt was Pta180.5 billion (approximately DM2.8 billion).

#### **Aerospatiale Inaugurates New Research Center**

*92WS0269P Paris LA LETTRE HEBDOMADAIRE  
DU GIFAS in English No 1543-2, 5 Dec 91 p 1*

[Article: "Aerospatiale Inaugurates New Premises at Suresnes"]

[Text] On 2 December 1991, Hubert Curien, France's Minister of Research and Technology inaugurated the new Aerospatiale premises at Suresnes. In 1988, a fire partially destroyed the former Louis-Bleriot plant where the firm's joint research center was located. The management of Aerospatiale then decided to rebuild the premises completely while all the time continuing activities. By the time all work is completed, the research center will be relocated in two buildings having a total floor space of around 30,000 m<sup>2</sup>, to which will be added another building having 20,000 m<sup>2</sup> of floor space for administrative purposes. The first building has now been inaugurated and will accommodate the joint Louis-Bleriot research center. The major tasks of this center include promoting technological innovations having a general interest for Aerospatiale, the independent handling of scientific and technological projects and the transmitting of all useful information from national or international sources to the group in general. The joint

research center is engaged in many national level corporation schemes involving manufacturers, research organizations, universities and technical schools. On the European level, it participates in the EUREKA [European Research Cooperation Agency] (data processing and products), EUCLID [Experimental Use Computer, London Integrated Display] (materials and stealth) and EUROMART [European Common Market] (materials and products) programs. In 1990, Aerospatiale research and development activities represented 12.5 billion francs. Of this amount, 2.8 billion or 35 percent of turnover was auto funded, 12 percent more than during the previous year.

### **DASA, Dornier to Develop Microgravity Chamber for ESA**

*Duesseldorf VDI NACHRICHTEN in German  
06 Dec 91 p 18*

[Text] Biobox: Deutsche Aerospace AG subsidiary Dornier GmbH which is headquartered in Friedrichshafen on Lake Constance, will develop a biobox for the European Space Agency (ESA) for conducting biological experiments under conditions of zero gravity in space, known as microgravity. In this way, it should be possible for the first time to have uninterrupted monitoring of tests using an expensively designed data acquisition system. The first planned mission for the biobox is on a Soyuz carrier rocket in November 1992. It is supposed to spend 10 days in space on board a Soviet Foton reentry capsule.

### **Air Bus A330 Final Assembly Slated for 1992**

*92WS0283A Stuttgart FLUG REVUE in German  
Jan 92 pp 9-14*

#### **[“Final Assembly Begins”]**

[Text] The production of the A340 and A330 aircraft was begun by Airbus Industrie in 1987 as a kind of twin program, wherein the two aircraft shared a high degree of communality. Besides the almost identical wings, both aircraft have the same fuselage and the same cockpit arrangement. The four-jet A340 was designed for distances up to 14,400 km, while the twin jet A330 is to be used for medium-range distances of up to 5,300 NM/9,800 km.

While the A340-prototype is already engaged in its test flight program, the first Airbus A330 is already beginning to take shape. The first unequipped wing for the A330 was manufactured in British Aerospace's Chester plant and flown to Deutsche Airbus in Bremen, where it will be equipped. The finished wing will then be transported to Toulouse by Super Guppy.

The final assembly of the first A330 gets underway in Aerospatiale in Toulouse in February, where, in addition to the wings, the complete forward part of the fuselage and the tail end are expected to arrive in the same

month. The middle part of the fuselage and the empennage arrives there as early as January. In the second quarter of 1992 the A330 will receive its General Electric CF6-80E1 engines, so as to be able to take off on its first flight in the third quarter.

Although only five such aircraft were ordered by the ILFC Leasing Company in 1991, Airbus Industrie can look to a more comfortable business situation with its A330 than with the A340. One hundred and forty three orders plus 112 options have been placed for the A330, while there are only 110 orders plus 105 options for the A340.

### **Air Bus A330 Flight Testing Initiated**

*92WS0283A Stuttgart FLUG REVUE in German  
Jan 92 pp 9-14*

#### **[Article by Volker K. Thomalla: “Take Off for Success”]**

[Text] *After the designers, the pilots and test engineers now have their say. They have subjected the Airbus A340 to the hardest tests and exposed it to the most adverse conditions in order to evaluate the aircraft's performance and other parameters. An incredible flood of data has to be reviewed before licensing.*

The first flight of the A340 in Toulouse on 25 October was the start of the most comprehensive test program ever undertaken by Airbus Industrie. The test flight of a new aircraft is one of the high points of each new development. It is in the test flight that the new aircraft has to show that it truly possesses all the designed performance features and that nothing stands in the way of licensing for general operation. About 7 percent of the entire A340/A330 development costs are allotted solely to the test flight.

As of 19 November, the A340 prototype had already completed six flights for a total of 30 hours in the air. Joining the first A340-300 in the first quarter of this year, are the next two aircraft, an A340-300 and the first shortened-200 version of the A340, whose length of 59.4 m is 4.3 m shorter than the 63.7 m long A340-300. These three aircraft will be equipped with a complete flight test system and will primarily be used to test the flight control system of the fly-by-wire-controlled airliner and its performance through the entire flight range.

Usually a five-man team is used in the test flights, viz, two test pilots and three test flight engineers, who service and monitor the test equipment. At their disposal in the cabin are two consoles with six monitors by means of which all the important data concerning the aircraft and its subsystems can be called up. In addition, cameras are installed inside and outside the aircraft to permit visual monitoring. It was by means of an onboard monitor, for example, that test flight director Gerard Guyot monitored the lowering of the landing gear during the landing of the prototype after its first flight.

The test flight equipment alone weighs about 21 tons, a large part of which is from the water ballast tank in the after cabin section, which is used to generate different center-of-gravity positions. The monitors, the other test flight instrumentation and the recorders for the some 20,000 parameters add another 17 tons. At the same time the aircraft have a telemetry data transmission system by means of which some of the data can be transmitted without delay in real time to the control center in Toulouse. The parameters to be measured are decided on before each flight.

#### Water Tanks Instead of Passengers

Among special equipment is a static pressure probe, which is suspended on an 80 m long cable in the vertical surface tip and which is rolled out during the flight. It can measure the current static pressure without interference from the turbulent motion of the aircraft.

For the crew's safety during the test flight, the A340 prototype has an emergency exit. On the forward right side of the fuselage, directly beneath the "4" and the "0" of the marking, is a hatch that can be opened from the cockpit and through which the crew can crawl to the outside.

The top takeoff weight of both A340 versions is 253.5 tons, including a fuel supply of 135,000 liters. Airbus Industrie gives 46.7 t as the maximum payload for the -200, and 47.7 t for the -300. The A340-200 has a subsurface cargo capacity of 26-27 standard LD-3 containers, depending, of course, on whether the airline has selected the optional subsurface space or not. The A340-300 can transport six additional LD-3 containers.

Both versions are driven by four type CFM56-5C2 turbofans, which, with a fan diameter of 1.836 m, now deliver 139 kN (31,200 lbs) thrust. After the first year of operation, this power will be boosted to 144 kN or 34,000 lbs.

In the second quarter of 1992, an A340-200 and an -300 will join the test fleet. They will however carry a reduced amount of test equipment. They will be equipped with seats, kitchen, and toilets instead, so that subsystems like the autopilots and air conditioning can be tested in prolonged operation. These two aircraft will be used to carry out fixed distance tests and long range flights lasting more than ten hours.

The sixth aircraft—another "long" A340-300—will round off the Airbus A340 test fleet in August 1992. It too will only be equipped with a partial flight test system. In this stage, pilots from the first purchasers as well as test pilots from the licensing authorities will also fly on the aircraft.

During the 14 months of the test program the aircraft will be subjected to a total of 2,000 flight hours involving the most demanding tests. Among these tests are that the aircraft's entire flight range will be flown, involving speeds of 100 knots (185 km/h) to Mach 0.90 and

altitudes from normal zero to 41,100 feet (12,500 m). During these tests safe operating limits are established for the airlines, flight performance is documented, and the layout and integration of all systems finally approved. The aircraft must also demonstrate their general fitness under the most diverse weather conditions. As a long-range aircraft, the A340 has to show that a change from moist tropical weather at the takeoff site has no more adverse effect on it than landing at an airfield near the polar circle in bitter Arctic cold. Such extreme weather variations are the order of the day in airline service. At any rate, the A340-200's range of 14,400 km will permit nonstop flights of previously unknown distances. The navigational instruments must demonstrate their ability to conduct safe flights over the North and South Poles.

#### No Failures Despite Water, Ice, and Lightning

The test pilots expect to make flights under icy conditions as well as flutter tests in which the control surfaces are made to vibrate in a way they would normally never be subjected to. Then there are the spectacularly effective demonstrations to show that 1) when taking off from a flooded airstrip, no water is sucked into the engine, and 2) a lightning bolt would not cause a total failure of the aircraft's electrical system. The demonstration of minimum takeoff speed will also be a very special test. In this, the aircraft takes off at such a low speed and high angle of attack that the tail often drags along the takeoff strip. During this test, a wooden plank is secured under the tail section to protect the aircraft.

The test flights should last 14 months and conclude with the certification of both the A340-200 and -300 by the European JAA Licensing Authority in December 1992. Airbus Industrie expects that U.S. FAA licensing will follow a short time later. After the test flights, aircraft numbers two through six will be converted to airline standards and delivered to the airline companies. Tentatively, Deutsche Lufthansa will receive its first A340-200 in January 1993, and the French Airline UTA, which is part of the Air France group, will take possession of its first A340-300 a month after that.

However, the work of the test flight team, under the direction of Pierre Baud, chief test pilot and vice president of Airbus Industrie's Flight Division, will by no means end at that point. In the fourth quarter of 1992 the twin jet counterpart of the A340, the A330, will begin testing.

The fatigue tests, which are not part of the test flight program, began in the spring of 1991 and were a partial prerequisite to begin the flight program. In these tests, an A340 wing was bent 4.02 m upwards at the Centre d'Essais Aeronautiques in Toulouse (CEAT) in order to simulate the anticipated peak load during the calculated service life of the structure. Other A340-A330 sections will be maltreated in the Industrieanlagen-Betrieb (IABG) in Ottobrunn commencing in mid 1992, in Deutsche Airbus in Hamburg commencing in 1993, and

in the Construcciones Aeronauticas S. A. (CASA) in Getafe, Spain, to confirm that the actual service life matches the designed service life.

After the testing program for licensing, the prototype of the A340 will remain at Airbus Industrie, where it will be used as an experimental carrier for advanced A340 models.

#### **Evaluation in Real Time: Telemetry Data Transmission Shortens Test Program**

Telemetry data transmission plays an essential role in the flight testing of the A340. The French Airbus partner Aerospatiale has a telemetry system in Toulouse capable of transmitting select data from the test aircraft to the ground in real time, where processing can begin even before the aircraft has landed.

This is a great timesaver, inasmuch as in previous flight tests the data was stored onboard the aircraft and was only available for processing after landing. The telemetry informs the engineers on the ground immediately whether the tests are proceeding satisfactorily or whether they have to ask the crew to repeat parts of the flight program again. Without telemetry, it would be necessary to carry out another flight.

Airbus Industrie was able to gather its first experience with the system during the testing of the A320. At that time there was only one control center, the so-called "Salle d'Ecoute" to monitor the aircraft. Today Aerospatiale has doubled the capacity to two control centers.

There are two small antennas on the A340 itself. One is on the fuselage directly beneath the cockpit, while the second one is integrated in the vertical control surface. In this way constant transmission of data is assured, since at least one antenna can be received by the ground from every flight position. The first A340 has two complete telemetry and antenna sets onboard, one of which is incorporated in the second aircraft when it is tested. The data from the aircraft is transmitted to receiving stations on the west coast of France, situated in Toulouse (2), Bordeaux, Saint Genis, and Saint Nazaire. Soon there will be a sixth station on the Mediterranean coast, which will considerably enlarge the test flight area. Remote-controlled space tracking antennas are linked to each other and to the telemetry center by satellite.

The transmission rate is 852 kilobytes, which permits continuous monitoring of 3,000 to 4,000 parameters. The range of the receiving systems is quasioptical and, depending on the flight altitude of the test, is about 250 km.

#### **"If Necessary, We Can Save Ourselves with the Parachute"**

(An Interview with Pierre Baud, Airbus Industrie's chief test pilot and flight operations business manager)

**Flug Revue:** You were the captain in the A340's first flight. Did everything go as planned?

**Baud:** Yes, everything functioned in the best possible way. We had planned for a 3.5-hour flight, but flew for five hours because we undertook more. For example, we calibrated the engines. At the onset of the tests, one has to know the performance of the engines exactly so that the flight performance data can be trusted. We call that the "engine health test"; it is repeated at the end of the flight performance test. In this way, you can determine whether and how the engine data has changed. After landing after the first flight, the aircraft was in a condition that would have permitted us to take off again the next morning if it had not been for the important structural checks which took up three to four days. Every part of the structure has to be examined to determine if there are any cracks or if a nut had become loose. The technical condition of the aircraft was excellent.

**Flug Revue:** Did not the A340 lose part of the probe towed behind the aircraft during the flight, the so-called trailing cone?

**Baud:** It broke off during a flight maneuver, a Dutch roll, when the cable behind the aircraft was being tossed around. But that was of no importance.

**Flug Revue:** Were there any differences in the behavior of the aircraft as compared with the simulator?

**Baud:** Yes, but they were expected because we knew that everything could not be simulated exactly on the ground. That has to do with the large size of the aircraft, with the length of the fuselage, and the flexibility of the structure. In that regard, we have an aircraft that differs from the simulator. The simulator cannot totally reproduce these effects in advance.

**Flug Revue:** You were the captain. What were the duties of the other crew members?

**Baud:** The copilot, Nick Warner, (incidentally the word copilot is poor here) was not a copilot at all in the airline sense, but really a second test pilot, who was able to form his own opinion as to the flight qualities. During the flight, we were constantly asking each other things like "what do you think of this or that behavior," and freely exchanged opinions without any sense of hierarchy. Of the three approaches at the end of the flight, he made one himself. There was a third crew member in the cockpit, the system engineer, whose job it was to monitor the integrity of the systems and to correct any anomaly, so that both pilots could concentrate on analyzing the aircraft reactions. Two engineers were at the test consoles. They made a deep analysis of all systems and were able to call up the various parameters on the monitor. When the landing gear was lowered, they could observe the data of each hydraulic line and motor.

**Flug Revue:** Did you have parachutes onboard during the first flight?

**Baud:** On the six flights carried out so far we always carried parachutes along, except for flight number four.

The fourth flight was to determine the cruising performance, which was not particularly dangerous. But at least during the next two months, if there is a danger of encountering anything unforeseen, we will carry parachutes. That is no problem.

#### **Aerospatiale to Study Light Launchers**

92WS0289 Paris AFP SCIENCES in French 19 Dec 91 pp 7, 8

[Unattributed article: "Aerospatiale Launches a Study of Smaller Rockets"]

[Text] Les Mureaux—After medium-weight and heavy launchers, "light" launchers: Aerospatiale, "industrial architect" of the Ariane-4 and one of the Ariane-5 manufacturers, is starting to study a rocket which, launched from a plane, could take satellites weighing 500 to 1,000 kg into low orbit.

"A preliminary study was requested from Aerospatiale," the head of the company's Strategic and Space System Division, Mr. Michel Delaye, stated on 18 December. Such a rocket could be launched from an Airbus (flying at Mach 0.8 at an altitude of 12,000 meters [m]), for instance; the first stage, or even the second, could be recoverable.

According to the Aerospatiale Space Transport Director, Mr. Francois Calaque, this solution would make for a "most efficient" third stage running on slush (a mixture of liquid and solid hydrogen). "The study," Mr. Delaye indicated, "currently mobilizes 30 engineers."

Actually, for Aerospatiale officials, and for their competitors, while there is a market for the next few years for launchers capable of placing increasingly heavy satellites into geostationary or low orbits (up to 10 tons into low orbit, the capacity of the future Ariane-5), a need for smaller launchers should also become apparent during the last years of the century (1998-2000).

Military satellites might account for a large proportion of this market, according to Mr. Delaye. In fact, the minister of defense, Mr. Pierre Joxe, recently emphasized the development of the military space sector and small observation satellites.

According to Aerospatiale officials, such a launcher could be developed in four or five years, but not by an agency like the ESA [European Space Agency], i.e. by many countries. Nevertheless, a partnership with someone else—"with the Americans," Mr. Calaque indicated—is a must. The decision to build such a rocket should be made in 1992 or 1993.

#### **Automotive Industry**

##### **Germany: Electric Propulsion Eliciting Greater Interest Among Automakers**

92WS0166A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 21 Nov 91 p 8

[Article by Wilfried Legat: "More and More Automakers and Suppliers Are Looking Into Electric Propulsion; Electric Autos as Urban Car of the Future; One-Quarter of All Trips Are Only Three Kilometers Long"]

[Text] Bonn—Since the IAA [International Automobile Exhibition], we have known what they might look like. The E 1 from BMW, for example, or the Chico from VW. The styling is futuristic, and in the meantime the subject has attracted attention around the world. Accordingly, they are no longer called solid German "electric autos," but rather "zero-emission cars." More and more automakers and suppliers are looking into electric propulsion. Opel, Bosch, and Siemens have set up separate departments for it. It is known that BMW, Mercedes, and VW have had such departments for years now. In any event, the electric car is no longer a screwball idea by imaginative hobbyists.

Up to now it has tended to be the opposite direction that has repeatedly inspired the auto industry to new superlatives: faster, bigger, more comfortable. Such cars are built and sold, even though they can scarcely be maneuvered any more amid the mass of other cars. According to prognoses by transportation specialists, who are more inclined to make cautious assumptions in such cases, the number of cars should increase from the current 36 million to 46 million in 2010. It is hard to believe that anything would even be able to move in such a scenario, especially in the cities. Condemned to absorbing both the moving and the stationary traffic, the city streets are to a certain extent the coronary arteries of the traffic system. In that case, the cities will also be the first place to be paralyzed by gridlock. Based on a study by Munich's Sozialdata Institute, commissioned by the Association of German Transport Companies, we know that one-quarter of all trips are shorter than three kilometers, and that half are shorter than five kilometers. Only one in five is longer than 100 kilometers. This finding is in keeping with those of a study conducted by the Institute for Applied Transport and Tourism Research in Heilbronn for the Federal Ministry for Transport, according to which a passenger car travels an average of 42 kilometers a day. In more than half of the cases, the driver is the only passenger. Although none of this provides a cogent argument in favor of the electric car, it does at least say something against the over-motorized multipurpose auto.

What does provide a decisive argument in favor of the electric car, however, is the heavy burden of exhaust gas, which is inevitable when cars with combustion engines are used. If this is already a general problem, then it is

truly troublesome in the cities, where the exhaust settles as hazardous concentrations of pollutants in poorly ventilated urban ravines. The level of nitrogen oxide pollution here is many times greater than the generally binding EC standard. The situation with other pollutants is scarcely any better.

Certainly, the auto industry is doing some things to rectify this evil. Certain improvements can still be made in the engines, and far from all cars are equipped with catalytic converters. But this will not achieve very much. Exactly one-third of what is necessary can be achieved with engine and catalytic converter technology. To achieve the nitrogen oxide limit required by the EC standard, we must come up with something different: for example, a switch to public transportation, a traffic-free center city—or the electric car.

California, which once made a name for itself by presenting the catalytic converter despite the continuous resistance of the automobile lobby, is once again demonstrating a possible course of action. In smog-plagued California, and thus in the major city of Los Angeles as well, 2 percent of the fleet of each auto manufacturer must run emission-free beginning in 1998. In 2003, this figure increases to 10 percent.

In the Federal Republic, admittedly, we cannot yet compete with examples such as this. However, Baden-Wuerttemberg and Bavaria, for example, and cities such as Wiesbaden and Baden-Baden are trying out the electric car in sizable fleet tests. The Federal Ministry for Research and Technology—which has thus far had a rather reserved attitude towards the electric car—is providing a DM20 million subsidy for a major industrial project on the island of Ruegen. At the same time, municipal leaders are gaining the courage to strictly ban cars with combustion engines from their cities' vital core zones. So what exactly are the arguments against the electric car? Most of them are economic in nature. The acquisition and operating costs are simply still too high. As long as they are not coming off the assembly line in large numbers, they are as expensive as the cars of the upper middle class. The biggest cost factor is the battery, the price of which depends on the number of units produced even more than with the car. Of critical importance, however, is the fact that although the auto industry is doing everything it can to prepare for future declines in sales and legislated regulation, it is doing absolutely nothing to provide its own critical impetus to this development. The auto industry is waiting for the lawmakers. And the lawmakers are waiting for the auto industry.

Quite a different situation in California, where pertinent laws were drafted. Anyone who still wants to sell conventional cars in a few years must not only offer absolutely pollutant-free models, but also get rid of them—regardless of the price.

There are many things about the electric car that remain to be developed or improved. Sodium-sulfur-based batteries discharge within several days if left alone, because they require an operating temperature of 300°C. Bromine-zinc and cadmium-nickel models are alternatives, but they are not yet at the stage of development for heavy everyday use. It could make sense to combine the battery-fed electric propulsion with a small-capacity diesel engine, as in the Chico. At Opel, thought is being given to how gasoline and electric engines could be alternated, depending on the type of use. Ford hopes to present a combination two-stroke and electric propulsion by no later than 1995.

The list of developmental efforts such as these could go on and on. However, mention must be made of the study by TUeV Rheinland, which in fact arrives at contrary conclusions in terms of eliminating the environmental impact caused by cars. According to that study, electric cars will not be particularly environmentally friendly, precisely because they will simply shift the problem from cars to power plants.

What initially seems disconcerting turns out to be untrue upon closer examination. Thus, it was assumed that additional power plants would be needed for the electric cars which—if they are heated with coal—would not be environmentally friendly. But in reality, 1 million electric vehicles would consume less than 0.5 percent of the generated electricity. Anything that the auto industry could build and put on the market over the next 10 years could easily be powered by existing power plants.

#### Italy: First Electron Synchrotron Slated for Trieste

92WS0166B Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 21 Nov 91 p 8

[Unattributed article: "First Italian Electron Synchrotron in Trieste; Far-Reaching Goals for Technical Conversion of Research Results; Elettra as Supplement to European Projects"]

[Text] Trieste—With the construction of an electron synchrotron in Trieste, the Italian government, together with Italian industry, is seeking to join in modern developments in new types of research techniques and the production of extremely fine structures for electronic circuits. Synchrotrons are particle accelerators used to study materials and nuclear reactions, but that are lately being used in significantly broader applications due to their ability to generate ultraviolet light and weak X-rays. Besides X-ray lithography, which can be performed with this light spectrum, they can also be used as X-ray microscopes to study biological structures and follow biological processes.

The new Italian electron synchrotron generates X-rays or photon beams in the range of approximately 10 angstroms. The system, called "Elettra," consists of a storage ring with a diameter of 260 meters. It is supplied

by a linear accelerator with an output of approximately 1.5 giga-electron volts. The electron beam is transferred into the storage ring, which is equipped with electromagnets, and can be removed at 12 points for surveying and experiments. The available photon spectrum lies between ultraviolet light and so-called weak X-rays. According to the existing advance calculations, Elettra will provide an unprecedented level of image brilliance due to a special design and beam control. Because of the extremely high exactitude of the discontinuous control system, it will also be possible to follow kinetic and dynamic reactions very closely without there being the possibility of material destruction, which had to be considered and avoided in previous, similar research instruments.

The entire facility, which is being set up above the city of Trieste in the mountainous karst area near Basovizza, requires an investment of more than 150 billion lire. Around half of this is coming from the Italian government's research fund. The rest is being shared by Italian universities and research institutes, as well as the regional government of Trieste. The research facility will provide jobs for around 150 people. It is planned that around 2,000 guest scientists per year will be able to spend a short period of time here pursuing their research. These will be primarily Italian electronic and materials engineers, for whom "Elettra" is intended to function as a central research instrument. Once the synchrotron starts up operation around 1993, it should contribute to the establishment of new foundations for electronics and the study of biological processes and structures. The Italian government hopes that through this facility it will be able to return its scientists to a leading worldwide position.

There are already several similar research instruments in Europe: CERN in Geneva, BESSY in Berlin, DESY in Hamburg. Elettra is a supplement, that will significantly expand European research work. With it, it will be possible to perform very exact structural studies of all materials, especially polymers and proteins, as well as nucleic acids, biologically active membranes, and inorganic compounds. At the same time, however, the weak X-rays allow the etching of new structures for electronic circuits in the range of fractions of micrometers. Thus, besides fundamental research, Elettra also opens up possible applications in extremely highly integrated electronic circuits. This should open the door to the coming generation of electronic chips for the Italian electronics industry.

Trieste is the easternmost city in Italy, at the northern end of the Adriatic Sea, and formerly an important harbor and transshipment point in the East-West trade. Since trade has fallen off sharply in recent years and industrialization is proceeding only moderately, the Italian government and the local parliament adopted a new course: They pushed the construction of a new university, and for several years now Trieste has had its own "research park," "AREA" (Area de la Ricerca),

which is more or less equivalent to the German research institutes in Juelich or Karlsruhe.

It is open to all researchers from Italian institutions and universities for fundamental research. Among the focal points of work, there are the developments of new semiconductor material combinations and new methods for communication technology, as well as biotechnical and molecular biology research.

During a visit by European science journalists, the research institute demonstrated some of the fundamental research projects for new types of semiconductor material combinations. Three different material groups can be applied successively to silicon substrates with a locally developed molecular beam epitaxy installation, compounds that based on prior experience are scarcely compatible. For example, various gallium and aluminum arsenides together with cadmium tellurides or zinc selenides. This opens up new areas of application for the manufacture of new very large scale integrated circuits with special electrical and optical properties.

Trieste is also the site of the only international university that, as commissioned by the United Nations, is attempting to convey basic know-how to scientists from nearly every less-developed country of the Third World. In this way, the city has become a scientific and technical transshipment point for Italy itself, to all its eastern neighbors, and for the nations of the Third World. With an adroit policy, Trieste could in the future become an important factor in European integration in the area of technology, especially with the neighboring countries to the east.

#### **Italian Firm Develops Low-Emission Fuel**

92WS0172A Paris AFP SCIENCES in French 7 Nov 91  
p 31

[Article: "Low-Emission Fuel Based on Vegetable Oils Being Tested in Switzerland"]

[Text] Milan—Italy's Ferruzzi-Montedison Group disclosed, on 4 November in Milan, that for several weeks now, five buses in the city of Zurich have been running on a new fuel based on vegetable oils, that was developed by the Group's subsidiary, NOVAMONT.

A press release by the Group indicates that, to date, after covering more than 70,000 kilometers, the test has produced excellent results. The release states: "Fuel consumption and performance are similar to those of traditional gas oil, and no particular problems have arisen with respect to engine operation."

The advantage of this new fuel, designated Diesel-B, is a reduction of approximately 50 percent in emission of polluting agents. Moreover, sulphurous components are totally absent and the fuel does not contribute to the greenhouse effect. The results of the test will be studied

by Switzerland's Federal Transportation Department from the standpoint of generalizing the use of this fuel in Switzerland.

#### **France to Test Electric Car Recharger Program**

92WS0172B Paris L'USINE NOUVELLE in French  
14 Nov 91 p 81

[Article by Stephane Farhi: "The Electric Car Beyond Its Battery Terminals: Recharging a Key Factor of System"]

[Text] The public sector is preparing for the advent of the electric car. In 1990, EDF [French Electric Power Company] launched a multi-stage program for the promotion and development of the electric car, beginning with expansion of its own fleet to between 200 and 300 cars by 1993, and progressing to participation in pilot tests like that at La Rochelle with PSA [Peugeot Corporation] in 1993. The EDF plan is geared, moreover, to a multi-year (20 million francs per year) research program on battery recharging, a point of absolute importance to the development of the electric car.

Around the beginning of 1992, EDF plans to test the prototype of a quick-recharge terminal in its Renardieres Research Center near Fontainebleau. EDF is also studying slow-recharge equipment. The two go together. The quick-recharge terminal is being planned initially as a user "fallback" system, in that the slow-recharge terminal would be the normal system for "filling up" the car with electric energy. "Our aim," says Jean-Luc Mazoyer, who heads the project for EDF, "is to install an electric car recharging infrastructure in the urban centers that desire it, by around 1994-1995," by which date-span PSA plans to have launched its mass production program (50,000 cars per year).

EDF has already fine-tuned the plan's main technical parameters: Supply voltages and electric power of rechargers and public terminals; safety and "user-friendliness" of these terminals; their geographical distribution; and invoicing.

The first two parameters differ depending on whether the "refill" is to be a slow recharge or a quick recharge. The slow recharge is meant to be a complete one, requiring six to 10 hours of charging time for lead-storage batteries. The public terminal in this case functions as a simple "plug-in" type power line connection delivering an alternating current of 16 amperes at 220 volts to a 3-kilowatt charger weighing between 15 and 20 kilograms and installed aboard the car. The car-borne charger converts the alternating current to the direct current output required to recharge the car's batteries. These terminals will cost 10,000 francs each, plus civil construction costs. The quick-recharge system requires terminals capable of delivering 15 kilowatts of direct current at the level of 100 to 150 and possibly even 250 amperes virtually ruling out the use of a car-borne charger (which would weigh between 70 and 100 kilograms). The objective in this case is to supply, in approximately 10 minutes of recharging time, some 20

kilometers of range, providing the driver with up to that amount of additional range before again having to recharge. These figures are as published for the PSA's Citela experimental vehicle equipped with Ni-Cd batteries.

EDF's solution: The 15-kW charger is to be incorporated in the public quick-recharge terminal. This terminal will cost five times as much as a slow-recharge terminal. And the vehicle will have to be equipped with a second "plug-in" type terminal of its own for this type of recharge. EDF and PSA are also developing a car-borne electronic system designed to communicate the required recharging characteristics (type of batteries, voltage) to the public terminal. This device will be tested with the system as a whole at Renardieres around the beginning of 1992.

Another aspect to be considered is safety. The terminal is protected by a differential circuit breaker, and will not supply any voltage whatever until firmly connected to the vehicle and isolated by a locked trap-like lid. The uncoiling of the armored power cable will be activated by the introduction of a credit card into the terminal. Touch-sensitive buttons will enable selection of duration of the recharge and available running times.

The installation of the terminals poses no problem, according to EDF, insofar as concerns connection to the low-voltage system. Their locations will depend primarily on decisions by the municipalities concerned. At La Rochelle, 100 terminals will be installed in groups of 10 to 15, in residential and business zones. Other locations have yet to be studied, such as town and city centers, and public and private parking lots. The locations of quick-recharge terminals will be different (service stations, traffic concourse).

Responsibilities for the setting of tarified rates, the infrastructure, and the sale of service are still open questions. And there is no lack of interested players: EDF, cities and towns, companies ...

#### **France: CO2 Laser Improves Camshaft Manufacturing**

92WS0185A Paris L'USINE NOUVELLE  
TECHNOLOGIES in French 14 Nov 91 p 22

[Article by Michel Vilnat: "A Laser For Hardening Camshafts"; first paragraph is L'USINE NOUVELLE TECHNOLOGIES introduction]

[Text] Citroen has opted for a CO2-laser recasting process that improves the resistance of camshaft necks and facilitates surface grinding, all in one-fifth the time.

Citroen is applying localized thermal treatments to the camshafts of its multivalve Diesel engines. This prevents wear of the camshaft necks. To boost the productivity of the operation, Citroen Industrie specialists devised a

new technique that reduces treatment time by a factor of five. Their secret: a laser beam that superficially recasts the molded metal.

Lasers have several advantages over the TIG [tungsten inert gas] recasting process now being used. For one, lasers produce only slight (a few one-hundredths of a millimeter) deformations; this greatly facilitates later surface grinding, especially since the necks are very close together on this type of part. For another, the hardnesses obtained are about a hundred vickers higher (about 750 vickers instead of 650). The latter is the result of the speed of the treatment, which promotes the formation of very fine and particularly hard carbides. Another advantage is the thickness of the recast layer, which is held to the strict minimum to increase shock resistance.

The first prototype of the machine (controlled by a NUM 1060 numerical control computer) was built in collaboration with the German laser manufacturer, Valfivre. It has a CO<sub>2</sub> source of 5.5 kW. Its rectangular-shaped beam treats the entire width of a camshaft in one pass. This particular beam concentration is produced by three cooled copper mirrors.

The already spectacular gains that this has created should be improved still more. Indeed, the final configuration of the production machine will have a CO<sub>2</sub> source of 8 kW. This boost in power will make it possible to lower total treatment time to seven seconds, compared to the 12 seconds needed now.

#### France: Methane to Fuel City Buses in 1992

92WS0217B Paris AFP SCIENCES in French  
28 Nov 91 pp 40, 41

[Article entitled: "A European First: Buses Will Run on Methane in Lille in 1992"]

[Text] Lille—In 1992, for the first time in Europe, four Lille metropolitan buses will run on methane gas produced in a water-purification plant.

Each day 1,110 cubic meters of methane produced by the plant will provide the energy equivalent of 1,100 liters of gas oil. According to scientists, the technique used is very different from the one employed in the gas generators of certain cars and trucks during the World War II.

The first phase of the program was unanimously adopted by the City of Lille, and consists in recovering the biogas produced by the Marquette-lez-Lille purification plant and purifying it. Once rid of its carbon dioxide, the biogas will conform to the standards of natural gas. Of the 10,000 to 12,000 cubic meters of biogas produced daily, 70 percent are used by electrical generators and the remainder is burned off with a surplus gas burner. It is that balance that will be purified and converted to methane.

The Community Environmental Observatory stresses that methane is presently the least polluting of automobile fuels: its use eliminates exhaust fumes and substantially cuts carbon monoxide and nitrogen oxide emissions.

Before the end of 1992, the purification plant should be equipped like the one that has been operating in Christchurch (New Zealand) since 1981, and conversion of the four buses should be complete. New Zealand manufacturers will collaborate on converting the diesel engines of the vehicles into Otto cycle engines, with spark ignition. In 1993, four more buses should be added to the first four.

The experiment was to have been conducted initially in Toulouse, but in the end it is Lille that will perform it first, primarily as a result of the push by one of Lille's assistant "Green" party mayors, Mr. Guy Hascoet. The EC and the Regional Fund for Energy Management have decided to financially back the program with Fr6 million.

#### Citroen Inaugurates Flexible Manufacturing Workshop

92WS0218A Paris L'USINE NOUVELLE in French  
5 Dec 91 pp 32, 33

[Article by Stephane Farhi: "Flexible Workshop: Citroen Industrie Turns Page"; first paragraph is L'USINE NOUVELLE introduction]

[Text] The new workshop for the production of engine prototype components has been put in service. A flexible cell and computerized control are replacing the flexible workshop installed at Meudon in 1983.

A change of era is under way at Citroen Industrie's Meudon plant. Eight years after having inaugurated a flexible workshop there that was then considered a model of its kind, the PSA's [Peugeot Corporation's] producer-goods subsidiary is turning the page...

For a time, the PSA's situation was touch and go. True, it was not alone in thinking, around the beginning of the 1980's, that automation and technological sophistication could not fail to result in productivity gains.

Citroen Industrie's new engine prototype parts workshop, which went into service in September, is now replacing a complex, highly automated, but not always flexible installation with one whose design is simpler, but whose computerization is more integrated. This solution is expected to yield a 50 percent gain in time needed to produce a kit of engine parts, for a reduced investment of 12.5 million francs[Fr], half of which is in computerization.

"Simpler and more streamlined," is the way Patrick Lernout, the official in charge of the project, describes the underlying idea. The first imperative has been to limit the investment. The 1983 workshop had cost the

mere bagatelle of Fr46 million! Hence the reduced floor space and the reuse of the machining centers and pallet crib. The automated tool crib is the sole new element.

The flexible workshop that stood proudly in the center of the Meudon plant has relinquished its place to a "standard" flexible cell that blends in with the decor. The machines are the same ones: two Graffenstaden machining centers, entirely renovated, served by a tool crib (336 emplacements) equipped with a gantry robot, and by a pallet crib. The cribs are located on both sides of the centers. A piece-preparation zone, a tool presetting center, and a three-dimensional measuring machine complete the cell. The entire assembly occupies an area of 400 square meters; that is, a third of the area of its predecessor!

A revealing symbol: The computer "control tower" that dominated the former flexible workshop has been abandoned. The computer unit is discreetly positioned at floor level, a few meters away from the machining cell. The wire-guided cars that routed the pieces between machining and washing centers have also disappeared; they have been replaced by conventional handling facilities.

The cell roughs out and semi-finishes prototype components for engines: cylinder heads, cylinder blocks, and gear-box and differential housings. Finishing operations are performed on two other groups of machines located around the plant: On one side, a miller and another machining center; on the other side, a jig borer and two precision boring machines, installed in an air-conditioned room. The entire cell operates with a staff of 30 persons. The integration of the data processing involved is a major feature of the new workshop. A two year, Fr6-million study was devoted to it, 60 percent of which went into the development of software by ESIA and Citroen's computerization staff. The hardware (a Digital Microvax with its peripherals), and communications (two Ethernet and Mapway networks), represented 20 percent each.

The system provides 24-hour management of the workshop and controls the flexible machining cell. The connection with the Citroen head office at Neuilly provides liaison with the different computerized production systems: Computer-aided group technology for product lines; computer-aided production management for scheduling; and computer-aided manufacturing for the machining of pieces.

The system's enhanced integration is expected to greatly improve the performance of this workshop. The flexible cell's overall efficiency (which takes into account the availability of its equipment and the quality of its operations) is expected to rise from 69 percent to 82 percent. Above all, Citroen Industrie expects to shorten the prototype production time by two weeks: to 20 days instead of the prior 35; that is to one third of the production time that governed in 1983 (60 days)! An additional step in the drive to shorten overall vehicle

development time, which PSA is seeking to reduce from five years to four by 1994. Citroen Industrie's new workshop is representative of the change that is taking place in industrial production engineering and management. To avoid the fate of the dinosaurs, flexible workshops will have to either adapt, or disappear.

### Electronic Diesel Control Improves Engine Environmental Safety

92WS0233A Duesseldorf VDI NACHRICHTEN  
in German 22 Nov 91 p 36

["Electronics Help Produce Environment-Friendly Diesel"]

[Text] VDI-N, Stuttgart, 22 Nov 91, sop—If the capabilities of mechanics have been pretty well played out, modern electronics is helping out with increasing frequency. Electronic diesel control (EDC) is playing an increasingly important role. Not only has EDC made modern diesel engines more comfortable and efficient, but now it has made them more environment-friendly.

As far as emissions control is concerned, the latest fast diesel automobiles can do more than just compete with the conventional internal combustion engine. They are already catching up in the overtake lane to vehicles powered by controlled catalyzer gasoline engines. And increasingly more auto-ignitions are not only meeting the already strict US-Norm '87 with respect to particles (0.2 g/mile) but the even stricter, so-called "Toepfer" norm with its low 0.08 g/km, which is the prerequisite for tax benefits for diesel vehicles in Germany.

These advances are not just due to engine development; they are also the result of increasingly better fuel injection components. Bosch is one of the leading producers of these components, which more than 100 manufacturers use worldwide. This Stuttgart company put the first injection system for diesel engines on the market as early as 1927, thereby paving the way for diesels as propulsion systems for vehicles. Another pioneer achievement occurred in 1987 when the first electronically controlled diesel injection system for both automobiles and commercial vehicles was developed.

The Stuttgart company in Europe and abroad built about 3 million multicylinder injection pumps in 1990 alone, not to mention the accessories like regulators, nozzle-holder assemblies, feed pumps, timing-advance devices, filters, and couplings. Since their mass introduction in 1962, more than 30 million distributor-type fuel-injection pumps have been produced.

Today, with increasing frequency, electronic controls complement the mechanics in diesel injection systems. Electronics permit the amount of fuel injected, the start of injection, rate of injection, and exhaust gas recirculation to be regulated more flexibly and more precisely. Even influencing variables like fuel and ambient temperatures, ambient and load pressures, and other parameters can be taken into account and auxiliary functions

developed. Among these are, for example, boosting speed when the air-conditioning is in operation, road speed control, or a maximum speed governor.

Consequently, more and more fuel injection systems with electronics are appearing. Whether it is a matter of rotary magnet positioners for distributor-type fuel-injection pumps or the linear magnet positioners for the in-line pumps, sensors like potentiometers to report the position of the control lever, the needle movement sensor in the nozzle-and-holder assemblies, the solenoid valve for controlling the start of injection, or a newly developed coupling switch on the mechanical governor—all require connecting cables to the control unit, both to transmit information as well as for power supply.

Despite the increasing importance of electronic controls and components, the mechanics in diesel injection systems, as Bosch himself emphasizes, remains crucial and indispensable. Because without the high-precision mechanical components, the differentiated commands of the electronic controls could not be translated. Moreover, many mechanical components offer path-finding further developments and new solutions that decisively improve the diesel engine. For example, a new double-spring nozzle-holder that permits the fuel to be injected in two stages. The advantage of this staged injection, brought out by Bosch in 1989, is a softer combustion process with a smoother pressure climb.

This technology, introduced in conjunction with the new, considerably softer, direct injection system, is now available for chamber engines as well. Another path-finding mechanical component is the modified accelerator pedal to adjust starting fuel delivery. By adapting the amount of fuel required for start-up to the engine temperature, the black smoke exhaust during start-up is simply but effectively eliminated.

Caption to photograph reads: Flow behavior inside the diesel injection nozzle is studied in a large-scale model in the Bosch Company's technical research center. A laser cross-section process and electrolytic gas-bubble marking make the flows visible.

### **British Automaker Installs First Complete MAP Communications Network**

*92WS0281B Duesseldorf VDI NACHRICHTEN  
in German 29 Nov 91 p 28*

[Text] Ellesmere Port, 29 Nov—British automaker Vauxhall Motors has put the first complete MAP 3.0 communications network into operation at its newly constructed paint shop in Ellesmere Port, Cheshire, Great Britain.

MAP (Manufacturing Automation Protocol), the data architecture for smooth EDP [electronic data processing] communication during production that was originally designed by the U.S. automaker General Motors, provides Vauxhall with a rapid exchange of information between computers and controllers made by different

manufacturers. In so doing, the Standard 3.0 installed by GE-Fanuc covers all seven levels of the protocol structure defined by the International Organization for Standardization (ISO). Thus, the network in service in Ellesmere Port connects the production facilities with a comprehensive monitoring and control system, which operates on the basis of DEC computers with a GE-Fanuc software package.

At present, the monitoring system controls 7,500 digital and analog data points throughout the paint shop. Two different systems are used to record and evaluate all this information.

Alarm messages that can result in a shutdown of production are transmitted directly from the stored program control (SPC) to the host computer without waiting for the next inquiry cycle or poll. At present, these alarm messages, which are generated unsolicited by the system, appear on the supervisory monitor no later than 0.5 seconds after the triggering event. In contrast, the host computer automatically queries less critical production sequences and data.

The host computer installation is the heart of the Vauxhall monitoring system. A group of five computers monitors and controls the manufacturing facilities in the various areas of production. The data from these computers are accepted by a server, which prepares a graphic representation before passing them on further. The second server stores the information in the system data bases.

These computer units are supported by other systems whose main purpose is to ensure the functioning of the MAP installation. Thus, a PC-supported status monitoring program checks the status of the wideband network. Its primary purpose is to monitor the signal level in the network and shut down individual parts of the cable system if necessary.

There are plans to expand the host installation so that data can be recalled from the system data base and transmitted to a group of Compaq computers. In this way, the departments responsible for organizing the production process would gain direct access to these data within the framework of program applications.

Among the additions to the system that Vauxhall engineers are currently working on developing are the automatic generation of preventative maintenance orders, the establishment of a library of SPC programs for production, and the monitoring of energy consumption throughout the entire paint shop.

Each SPC is equipped with a MAP interface in order to ensure in general a reliable and fast exchange of data between the host and the SPC and vice versa.

The MAP communication between the host computer and the SPC passes through a four-channel high-speed data line, similar to those used for cable television hookups. At the Vauxhall installation, MAP is only one

of four communication services that use this transmission medium. The network there is installed in the form of a primary conductor with branches. Amplifiers in the primary conductor ensure a uniform signal level throughout the network. In addition, a token bus system supports the devices working on the basis of the MAP protocol.

## Biotechnology

### Smaller Number of AIDS Cases Reported

92AN0080 Groot-Bijgaarden DE STANDAARD  
in Dutch 18 Nov 91 p 8

[Text] The number of AIDS cases in the Netherlands has decreased during the first half of this year, according to the latest figures of the National Commission for AIDS Control. During that period, 191 people caught AIDS. In the same period last year, the number was 213. The Commission estimates that this year a total of 375 people will contract the disease; last year there were 402.

For the first time since AIDS was recorded in the Netherlands, the annual increase is now reversed. A total of 1,886 persons have been infected by AIDS in the Netherlands so far.

The president of the commission warned against the idea that the epidemic is under control. The commission notes an increase in unsafe sexual behavior.

### Belgium: Plant Biotechnology Research Projects Summarized

92AN0102 Groot-Bijgaarden DE STANDAARD  
in Dutch 13 Nov 91 p 11

[Article signed L.S.: "Biotechnology Develops 'Light' Cow with Less Fat in Milk and Meat—Research Projects at Ghent's Agricultural Faculty"]

[Excerpts] Ghent—Some 550 million plants are currently being reproduced worldwide by in vitro cultivation. In Belgium, this industry sector has developed mainly in Flanders which supplies 30 million of the 32 million plants cultivated in commercial laboratories. Gerberas, carnations, and chrysanthemums are the most common. This segment of the much larger biotechnology sector provides 300 jobs in a dozen laboratories in Flanders. This highly export-oriented sector has grown out of scientific research on plant biotechnology carried out at the Agricultural Faculty in Ghent. To date it is the only profitable sector of biotechnology. In a few years this may also be true for cows producing milk and meat with less saturated fatty acids. [passage omitted]

### Virus-Free

[passage omitted] Since the liberalization of East Europe, laboratories in the West are faced with competition based on cheaper labor. It is now necessary to reduce labor costs through automation or by developing more advanced techniques.

Micropropagation is still suffering from growing pains, according to Prof. Pierre Debergh, head of the horticultural laboratory at the University of Ghent. Since 1977 the laboratory has been involved in research to solve such problems as bacterial infections, genetic stability, and abnormal growth behavior.

In the laboratory for food technology, chemistry, and microbiology, Prof. Andre Huyghebaert is in charge of research in the field of nutrition biotechnology. One research topic is the development of rapid methods to trace harmful microorganisms in food. [passage omitted]

Methods such as DNA tests have developed from biotechnology. Research is focused on the development of such a test for the detection of the *Campylobacter* bacteria. This causes a disease which has long been underestimated but is now considered as harmful and important as salmonella.

A second research topic is the utilization of by-products from the food industry. The processing of agricultural and fish products for food generates by-products, such as whey (cheese production), blood, and fish oil, which are not utilized adequately.

Research is aimed at isolating specific components from these by-products, in particular proteins from whey and slaughterhouse blood and the valuable unsaturated omega-three fatty acids from unpleasantly smelling fish oil.

In the research center for food, livestock, and meat technology, Prof. Daniel De Meyer and his team are attempting to improve the quality of fat compositions in ruminant produce—milk, meat, and adipose tissue—for public health reasons. It is their intention to make fats in these products less saturated.

### Rations

This is possible by controlling the ruminant's digestive system and eliminating bacteria in the animal's rumen which have the undesirable habit of transforming unsaturated fatty acids into saturated fats by adding hydrogen atoms. In this case it also makes sense to add unsaturated fatty acids in the livestock feed. De Meyer obtains the fatty acids from, for instance, a colleague who isolated them from fish oil. This is how the "light cow" comes into existence.

The same center is also working on improvements in the digestibility of livestock feed materials for pigs. This is a significant aspect for Flanders as it contributes to the reduction of manure output. One technique which has been investigated involves a kind of predigesting the

feed—i.e., before it is fed to the animal—by means of enzymes. These enzymes open up the cell wall structure of the feed components that are difficult to digest and consequently the animal utilizes its feed ration more effectively and produces less manure.

In Prof. Erik Vandamme's general and industrial microbiology laboratory, bacteria, yeasts, fungi, and algae are the workhorses for the production of precision chemicals. These microorganisms have to be activated, by adequately manipulating their genetic material, for the production of components whose chemical synthesis is unknown.

The range of applications is wide: the production of antibiotics, dyes, aromatic and flavoring substances, vaccines, immunizing substances, bioinsecticides and biopesticides, proteins (such as interferon and insulin). In the Agricultural Faculty attention is focused on, among others, the utilization of antibiotic-like properties of lactic acid bacteria, the production of polysaccharides (sugars), and sugar-based cellulose. The latter means that bacteria are already substantial producers of cellulose. The material can be used as a membrane, artificial skin, or even as fiber for human food.

Joint ventures between bacteria or, in more scientific terms, microbial mixed cultures, is the field of Prof. Willy Verstraete's microbial ecology laboratory. Mixed cultures are utilized to clean up or bring about transformations in open systems, such as water purification installations and soil.

Current projects cover the purification of surface and submerged soils, measurement of pollution using biosensors, and the development of biopesticides.

Reducing hindrance caused by the smell of manure is undoubtedly another current research topic. This is achieved through experiments on artificial stomach and intestine systems of animals. With the aid of mixed microbial cultures, the digestive system is simulated in reactors and influenced with the intention of ultimately producing manure which does not smell so bad.

Drugs and food components can be tested in a simulated human stomach and intestine system eliminating the necessity for laboratory animals. Special attention is being given, again for public health reasons, to the testing of cholesterol reducing microorganisms.

#### **EC: March 91 AIDS Figures Reported**

92AN0108 Groot-Bijgaarden DE STANDAARD  
in Dutch 25 Nov 91 p 14

[Article: "AIDS in Europe: 50,000 Cases Reported"]

[Text] Ghent—As of 31 March 1991, the European Center for AIDS in Paris had registered 49,525 cases of this disease. In proportion to its population, Switzerland has the lead, followed by France, Spain, and Italy. This

was announced at a symposium in Ghent. AIDS is reported exclusively on a voluntary basis.

Among the new AIDS cases, drug users are in the majority. Along with heterosexual patients, they form the fastest growing group, says Dr. Piot of the Antwerp Institute for Tropical Medicine.

By 30 June 1991, 896 AIDS cases had been reported in Belgium, whereas 6,864 persons were found to be seropositive as a result of a test. Every day, three new seropositive patients are identified.

In many cases, these patients have carried the infection quite a long time. It is estimated that about 15,000 people are seropositive in Belgium.

#### **Netherlands Extends Law on Genetically Modified Organisms**

92AN0113 Rijswijk BIONIEUWS in Dutch 22 Nov 91  
p 1

[Article by Jos van den Broek: "No New Law for Genetically Modified Organisms"]

[Text] No new, let alone overall, legal framework for genetically modified organisms (GMO's) will be created [in the Netherlands], for the time being. The present legislation is being extended for a period of four years. This was announced in a joint letter by the ministers of housing, regional development, and environment and the minister of agriculture and fisheries to the Second Chamber.

New regulations covering the different aspects of GMO's have recently gone into effect or are being prepared, say both ministers. As far as the protection of man and the environment is concerned, the "Hindrance Law" has been applicable for institutions such as laboratories since 1980. For other applications of GMO's, the GMO Decree based on the Environmentally Hazardous Substances Law has been applicable since 1 March 1990.

New regulations will be added to the Working Conditions Law in order to protect employees against the risks of exposure to biological agents, in line with EC directives (before 29 November 1993). The health and well-being of animals are guaranteed by the Law on Animal Health and Well-being (voted on 17 May) and proposed by the Bill on Animal Experiments (which was submitted to the Council of State).

The ministers believe that existing regulations and those which are being prepared, sufficiently cover the various aspects of the GMO issue. The legal framework, however, will have to be assessed in order to maintain sufficient insight into the issuing of new GMO regulations and into their practical implementation. The results of these assessments should be available within four years. The Dutch Industrial and Agrarian Industry Association (NIABA), which had urged the ministers not to pass a separate law on GMO's, said through its

manager/secretary Dr. J. van Lissa that it was pleased with the letter addressed by ministers Alders and Bukman to the Second Chamber.

### **"Bio-Future" Research Program to Accelerate Technology Transfer**

92WS0140E Paris LE MONDE in French 10-11 Nov 91 p 13

[Article by Catherine Vincent: "With a Budget of 1.6 Billion Francs Over Five Years, the 'Bio-Future' Research Program Is Being Set Up"]

[Text] The "Bio-Future" program adopted last month at a ministers' council was presented on Wednesday 6 November by Rhone-Poulenc, the leading French chemical manufacturer, which will devote 1 billion francs [Fr] to it over the next five years. Over that period, the program will receive another Fr610 million from the Ministry of Science and Technology; the program objective is to accelerate technology transfers in the fields of health, agrochemistry, and chemistry. According to Rhone-Poulenc, the program—to which Roussel-Uclaf has "agreed in principle" to participate—might recruit "up to 500 researchers."

Implemented with the collaboration of the leading public research organizations (CNRS [National Center for Scientific Research], CEA [Atomic Energy Commission], INRA [National Agronomic Research Institute], INSERM [National Health and Medical Research Institute], Pasteur Institute), "Bio-Future" is the most important of the three new major industrial research programs adopted by the State (LE MONDE 24 October). Not just through its financing (Fr1.6 billion over five years) but also through its economic stakes, since the potential market for its industrial spinoffs worldwide is estimated at Fr300 billion by 1995. The objective of the Rhone-Poulenc group is to strengthen and synchronize "the capacity for innovation" at the frontiers of chemistry and biology, "by accelerating interactions and transfers between basic and applied research." A major orientation of the program will be to "radically" transform living molecule research methods.

Involving either agrochemistry, chemistry, or human health, life-science research designed to develop industrial applications implies that thousands of genes and proteins will have to be collected and synthesized. These molecules have been studied empirically for a long time and can now be analyzed, and above all altered in an infinitely more rational manner than in the past, thanks to the progress of genetics and biochemical analysis techniques (NMR [nuclear magnetic resonance], crystallography, computerized modeling). But this will require research coordination in a field which, to a varying extent, calls on practically all the disciplines of modern biology.

### **Industrial Partnership**

This is Rhone-Poulenc's acknowledged current objective. Under "Bio-Future," human health research will involve, in particular, ways to treat vascular diseases, the leading cause of mortality in France. In agrochemistry, it will cover primarily the development of new herbicides and fungicides whereas, in chemistry, it will emphasize enzymatic catalysis. "The program is not set, and no strict distribution of financial resources among the three sectors involved has been decided," Mr. Philippe Desmarescaux, the group's research supervisor, indicated.

"With a budget of Fr1.6 billion over five years, we will be able to recruit up to 500 researchers, as needed. And we shall not hesitate to accept other partners quickly," he added. The first of these partners has already been found: the Roussel-Uclaf pharmaceutical group (the French subsidiary of the German Hoechst), which called Rhone-Poulenc's approach "excellent," in fact just announced that it would participate in some of the research carried out under "Bio-Future." Roussel-Uclaf's management, however, indicated that "this agreement in principle is not yet accompanied by any formal decision as to the nature of the research and the amount of resources to be devoted to it." The partnership will operate far upstream from any industrial spinoffs—because the two partners also compete with each other—but it nevertheless illustrates the common determination of these two large biochemical companies to score quickly against their American and Japanese competitors.

### **Dutch Biotechnology Research Assessed**

92AN0153 Rijswijk BIONIEUWS in Dutch 6 Dec 91 p 1

[Article by Fridus Valkema: "Biotech Commission of Inquiry: 20 Million Guilders Insufficient"]

[Text] The 20 million guilders in subsidies to be appropriated by the Ministries of Economic Affairs and of Education and Science for biotechnology over the next five years are absolutely inadequate. This low budget jeopardizes the strong international position presently held by Dutch biotechnology. A total of 50 million guilders is required over a period of five years. With the contributions from the universities, the overall budget should amount to 100 million guilders. This was argued by the international commission which assessed Dutch biotechnological research. Its final report was published last week.

The commission was composed of Prof. C.L. Cooney (MIT, Cambridge MA), Prof. M. van Montagu (Ghent), Prof. L. Philipson (EMBL [European Molecular Biology Laboratory], Heidelberg), Prof. C. Ratledge (Hull), Prof. H. Sahm (Julich) and was headed by Prof. B. Zwanenburg (Catholic University of Nijmegen). Mrs. C.M. van den Heuvel acted as a secretary on behalf of the principal

KNAW [Royal Dutch Academy of Sciences]. The commission of inquiry examined the impact of the innovation-oriented biotechnology research program (IOP-b). This survey started in 1982 and was concluded by mid-1990.

The commission is impressed by the way in which researchers participated in this IOP-b. The commission believes that four centers are particularly important for biotechnological research. They are eligible for additional funds:

- The Biocenter of the VU [Free University] and UvA [University of Amsterdam] in Amsterdam (which was meanwhile granted the status of prospective research school);
- Biotechnology Delft-Leiden;
- BIOSON in Groningen;
- The groups at the LUW [University of Wageningen] which presented themselves to the commission of inquiry (food product technology, microbiology, genetics, phytopathology, and biochemistry), plus the research activities in the field of plant biotechnology and environmental biotechnology.

In the opinion of the commission, these groups can take a leading international position in the next five years, if not before.

This is not true for the Groningen Biotechnology Center. There are too many vacancies here and research is too incoherent. It would be best for Groningen to concentrate on protein structure research at the BIOSON institute. The commission recommends support for biotechnological research in Groningen on a project basis rather than on an institute basis.

This is also true for the Institute for Molecular Biology and Medical Biotechnology of the RUU [State University of Utrecht]. Only the vaccine research, in particular research on carbohydrates, deserves to be supported further.

The biotechnology projects in Nijmegen would be advantageously integrated with those in Wageningen.

The commission is surprised that certain universities, including Nijmegen and Wageningen, did not present all of their biotechnological research activities. The commission advocates that a national biotechnology program should be established in succession to the IOP-b.

#### **EC, Japan, U.S. Agree to Greater Cooperation in Pharmaceutical Experiments**

92WS0161C Paris LE MONDE in French 15 Nov 91  
p 36

[Article by Jean de la Gueriviere: "Europe, United States and Japan Agree to Coordinate Pharmaceutical Experiments"—first paragraph is LE MONDE introduction]

[Text] At the conclusion of an international conference held in Brussels 5-7 November at the initiative of the European Communities Commission, the Twelve, the United States and Japan committed themselves to a significant reduction of redundancy in the testing of pharmaceutical products and use of laboratory animals. A 30-page document on the subject will soon be published.

Brussels—Announcing the broad outlines of the document on Wednesday 13 November, a spokesman and the head of the Commission's "pharmaceutical unit" said that "more than 1,000 participants from industry and various governmental bodies participated in the work of this unprecedented effort to agree on general principles to facilitate coordination of everyone's activities."

Almost every year, about 60 new substances (40 percent of them developed by European research) are put on the market. In many cases, the manufacturer has been forced to spend 10 years testing them. And further pre-marketing tests are required to comply with national regulatory provisions. "We must avoid duplication that serves no purpose, automatic research to satisfy everyone's standards," the Commission official explained. The idea is that once a test has been conducted, officials in each country can interpret the results as they see fit, but repetition is to be avoided.

Up to now, for example, separate tests in Europe, the United States and Japan were conducted in order to determine a medication's "stability," that is its preservability under various climatic conditions. A tripartite accord will reduce such testing by 30 percent, cutting on average 100,000 ECU's [European Currency Units] from the cost of developing a new drug. In the important field of "reproduction tests"—those that have to do with the possible effects that medication taken by the mother may have on her child—"the guidelines in force in the three regions have been recognized as equivalent, pending the adoption of a common standard, which will be proposed in 1992."

The Europeans, Americans and Japanese have committed themselves to coordinate their requirements relative to pharmaceuticals for the elderly, in view of the need to develop specific medications for this increasingly vast clientele.

#### **Fewer Animals**

In addition to direct cost-cutting measures, in a field where on average research represents 15 percent of a product's final cost, public pressure over the use of animals in testing is being taken into account. An agreement was reached to reduce from 12 months to six the duration of tests for chronic toxicity of medications. "This means that some 200 fewer rats and 48 fewer dogs will be needed to verify the safety of each new substance." Intentional fatal dosage tests—what specialists call "establishing the LD-50" [dose that is lethal for 50 percent of animals tested]—will simply be abandoned.

Canada and the other European countries of the AELE [European Free Trade Association] had sent observers to the conference. The general principles that came out of it supplement the Community harmonization program already under way. Among the Twelve, consideration is being given to the idea of creating a European Medicines Agency, which could eventually issue a single marketability authorization valid throughout the Community. The ministers of health touched briefly on this question at a council in Brussels on 11 November. Like his German colleague, Mr. Bruno Durieux said there was no urgency about establishing the agency if the purpose was just "to substitute a centralized procedure—with more bureaucracy—for our existing mechanisms."

### Swiss, Dutch Firms to Develop Pharmaceuticals Jointly

92WS0169C Paris *LE MONDE* in French 23 Nov 91 p 28

[Article entitled: "La Roche-Akzo Medications Agreement"]

[Text] The pharmaceutical groups Hoffman-La Roche (Switzerland) and Organon (a subsidiary of the Dutch firm Akzo) concluded a research and development agreement to develop medications for the treatment of depression, anxiety states, schizophrenia, and other related illnesses. The products will be marketed separately, but the rights for the entire world will be shared by Organon and La Roche. Akzo is one of the largest chemicals manufacturers in the world. It employs 65,000 people in its 350 subsidiaries. The Organon company, which has 6,900 employees, is active in particular in medications for use in oncology, immunology, and gynecology.

### Germany: Optical Biomolecule Analysis Apparatus Developed

92MI0176 Bonn *DIE WELT* in German 7 Dec 91 p 20

[Text] The functioning of biomolecules such as proteins depends crucially on their three-dimensional shape, which is normally revealed by X-ray structural analysis. An intensive X-ray strikes the biomolecules present in crystalline form; the ray is then diffracted in an entirely characteristic way on the crystal, i.e., deflected in various directions. Previously, however, this method has worked only with specially prepared samples, in which heavy metal atoms had to be embedded in the molecules as clearly identifiable reference points in the molecule, similar to bearing marks in surveying. Scientists at the Society for Nuclear Power Exploitation in Shipbuilding and Shipping Research Center in Geesthacht (GKSS) have now succeeded in using the types of atoms occurring naturally in proteins as "microscopic bearing marks," sulfur and phosphor proving suitable "native" marks. At wavelengths of about 0.5 nanometers, sulfur has an absorption edge that gives a high degree of image contrast for measurements. Besides using synchrotron radiation, which is extremely intensive in the X-ray range,

the researchers have achieved their aim primarily by designing high-precision optical components and detectors: The advantages are that the biomolecules are not distorted by the metal atoms and that only relatively small and easily produced crystals are needed for structural analysis, thus greatly increasing the number of biomolecules that can be analyzed by X-ray structural analysis.

### Rhone-Poulenc Launches "Biofuture" Life Sciences Research Program

92WS0180A Paris *INDUSTRIES ET TECHNIQUES* in French 15 Nov 91 pp 12, 13

[Article by Valerie Borde: "Rhone-Poulenc Sees 'Bio' in Its Future"—first paragraph is *INDUSTRIES ET TECHNIQUES* introduction]

[Text] A research program on life sciences worth 1.6 billion francs [Fr] is being launched. It will cover health, agrochemistry, and chemistry.

Rhone-Poulenc just announced the launching of "Biofuture" [Bioavenir], its large research program on life sciences. Designed to last five years, it has a budget of Fr1.6 billion, one third of which is financed by the State. Its goal is to advance basic knowledge in the fields of health, agrochemistry, and chemistry, and to accelerate the industrial application of basic knowledge.

"Biofuture is the implementation of a radically new scientific approach," Claude Helene, Rhone-Poulenc scientific manager and professor at the Museum of Natural History, explained. The random discovery of new molecules is replaced by an approach directly geared to the disease to be cured.

Traditionally, the research of new molecules effective against diseases or to protect plants uses an elimination process. Thousands of molecules are synthesized and then tested; eventually, a number of products are selected that offer an acceptable tradeoff between the beneficial effects looked for and the undesirable side effects. The explanation, after the fact, of the action mechanisms of these molecules is used to guide further research. A different approach will govern the Biofuture program.

In the first stage, thanks to the progress of molecular biology, researchers will identify and characterize new biological "targets": the enzymes that must be blocked, the cells that must be destroyed. For instance, to improve plant protection against an insect, the plant gene responsible for its resistance will be identified. Using molecular computer-aided design (molecular CAO), X-ray crystallography, and three-dimensional nuclear magnetic resonance (for which the Swiss Ernst was just awarded the Nobel prize for chemistry), researchers can model an increasing number of biological phenomena and manage to lay out atoms in three dimensions. At this stage, the target is perfectly well known.

After that, appropriate molecules must be manufactured through controlled chemical synthesis. The activity of these molecules is then tested on live models. Transgenic animals, a key factor in the Biofuture program, play an essential part in this respect. Indeed, how can we test a molecule against cardiovascular diseases such as atherosclerosis? By introducing a foreign gene into the genome of an animal or by selectively replacing one of its genes, we can obtain animal models of human pathologies that were unavailable until now. One section of Biofuture will be devoted to the development of such models. The researchers will also have to complete toxicity models for the molecules and achieve progress in predictive toxicology: to save time, we must know as soon as possible whether a molecule is toxic.

At this stage, scientists have in their hands molecules effective for the desired treatment. They must then determine how to administer them, i.e. study biological access to the target. What is the formulation that will make it easier? Biofuture will develop product formulations providing both a good dispersion into the organism, and controlled release of the active molecule. One third of the funds will be allocated to research designed to develop these new methods.

They will be applied in three domains dear to Rhone-Poulenc: human health, agriculture, and chemistry. "Biofuture hinges on well-defined programs; there will be no scattering of funds among a multitude of research teams," Jean-Luc Bourgeois, of the Ministry of Research, indicated. In the health field (one third of the funds), three themes were adopted. "They correspond to strong points in French and Rhone-Poulenc basic research," Philippe Desmarescaux, who supervises the group's research, explained. The first one is atherosclerosis, responsible for 500,000 deaths per year in western countries. This cardiovascular disease will cause infarctions, embolisms, and arthritis, depending on whether it manifests itself in the heart, the brain, or the legs. Rhone-Poulenc, the INSERM [National Health and Medical Research Institute], and the Pasteur Institute have been working together on this subject for a year, in a joint laboratory in Lille. As for the other two major themes, they concern cancer, with the research of medical drugs to control tumors, and diseases of the central nervous system, for which the mechanisms of neuron degeneration must be explained.

In agrochemistry, the objective is to achieve clean agriculture: to discover less polluting herbicides that can be used at low doses and are not toxic. The objective is also to help plants resist foreign aggressors (insects, drought, etc.) on their own, by modifying their genetic makeup. In this respect, Rhone-Poulenc Agrochemistry is already a leader when it comes to testing transgenic plants: the INRA [National Agronomic Research Institute] is its privileged partner in this field. "Chemistry research is a spin-off of research in the life sciences," Claude Helene explained. Where traditional chemistry becomes too

unwieldy or too inefficient, there probably exist molecules capable of replacing chemicals to catalyze reactions. Microorganisms can also drastically change some of the chemistry by producing new molecules on their own. Chemistry and agrochemistry will share the remaining third of the financing.

[Box, pp 12, 13]

#### The State Provides Fr610 Million

In the past few years, through multiple acquisitions, Rhone-Poulenc has considerably refocused itself on life sciences. The Pasteur-Merieux-Connaught group, the inclusion of Rorer in 1990, and the development of the agrochemical sector have helped the company leap forward in this field from which it now derives 43 percent of its sales (i.e. Fr35 billion). For Biofuture, Rhone Poulenc will contribute Fr1 billion, the State Fr610 million. Very basic, the program is supported mostly by the Ministry of Research and Technology (MRT), with a contribution of Fr410 million. The Ministry of Industry will provide the remaining Fr200 million.

"Biofuture is a 'psi' program, the acronym standing for 'strategic program initiated by manufacturers,'" Jean-Luc Bourgeois, head of large programs at the MRT Research and Industry Department, explained. "If no other manufacturers are involved in the project, it is merely because no one is interested in Biofuture for the time being, but the program remains open," he added. No comment at Sanofi [Aquitaine Financial Corporation for Hygiene and Health], which is said to have actually refused to join Biofuture. At any rate, Rhone-Poulenc will have to submit its results regularly to the scientific community and to other manufacturers. "It is a somewhat risky program, as it includes only one company, but we shall make sure there is no abuse," Jean-Luc Bourgeois assured.

In Biofuture, Rhone-Poulenc will be the partner of public research laboratories: the CNRS [National Center for Scientific Research], the National Agronomic Research Institute (INRA), the National Health and Medical Research Institute (INSERM), the Atomic Energy Commission (CEA), and the Pasteur Institute. Biofuture will be supported by a total of about 500 researchers, 200 of whom are from public organizations. Some 80 theses will be started over the five years.

The CNRS will receive one third of the pie, the INRA and the INSERM one fourth each, and the CEA, the Pasteur Institute and a few university laboratories will share the rest among themselves.

The program will be directed by four strategic orientation committees consisting of representatives of Rhone-Poulenc, and participating ministries and research organizations. Headed by experts, the committees will define the content and schedule of research programs and allocate the funds. Axel Kahn of the INSERM, chairman of the biomolecular engineering commission, is the

expert for the health sector. Agrochemistry is the province of Andre Berkaloff, president of the INRA scientific council; and Gilbert Durand, the French representative in Brussels in charge of biotechnologies, has made an expert assessment of the chemical-processes sector.

#### Switzerland: Genetically-Engineered Potatoes Field Tested

92WS0184A Zurich NEUE ZUERCHER ZEITUNG (INTERNATIONAL EDITION) in German 5 Dec 91 p 29

#### ["Gene-Manipulated Potato Fields Virus Free"]

[Text] *Last Tuesday the administrators and researchers at the Swiss Agricultural Research Facility Changins (RAC) released to the media the first results of an ongoing outdoor field experiment with genetically engineered potatoes. The experiment was deemed a success in that the immunized potatoes demonstrated 100 percent-protection against certain viruses. It is as yet not possible to make final assessments as to any side effects.*

*Changins, 3 December* The purpose of the genetic alteration performed in the potatoes at Changins, which are the first gene-manipulated plants in Switzerland to have been tested in an outdoor field experiment, is a kind of "genetic immunization" to achieve protection against the PVY—a virus that causes great damage in seriously infected potato crops.

Potatoes had already been successfully immunized under greenhouse conditions. It now appears that this field experiment confirms that success when potatoes are cultivated under normal agricultural conditions. Although the experiment has not yet ended, it may be concluded that genetic immunization has provided total protection against the virus. However, RAC director Alexandre Vez emphasized that it is still not possible to make a final statement about possible side effects. Genetic immunization consists essentially in the introduction of a specific gene of the virus in the genetic make-up of a plant cell. From this genetically altered cell, plants, which are resistant to the particular virus, are then cultivated *in vitro*.

#### The Potatoes Are Fully Protected, the Leaves Partially So

All of the hundred or so immunized Bintjes [potato variety], which were planted in the field experiment, were derived from the same cell. They had been immunized against one form of the (PVY<sup>N</sup>) virus. This prompted the question as to whether they had also gained immunity against another widespread form of the same virus (PVY<sup>O</sup>). In early May, the immunized Bintjes were planted in alternating rows with non-immunized Bintjes and with potatoes seriously infected by the virus. Studies with the very sensitive Elisa virus-detection test showed that 98 percent of the leaves of the non-immunized Bintjes were infected. Only 22 percent of the

leaves of the immunized Bintjes were infected—and only by PVY<sup>O</sup> virus, not the PVY<sup>N</sup> virus.

Furthermore, the potatoes grown from immunized plants were all PVY-free, while all the non-immunized Bintjes were infected. Pia Malnoe, who is the researcher in charge of the experiment, emphasized the importance of these findings. Plants, derived from infected potatoes, exhibit very destructive secondary infections. Consequently, the best prevention against PVY-damage lies in the close examination of the seed potatoes.

#### Unexplained Shape Change

On the other hand, 35 percent of the potatoes derived from immunized plants exhibited a change in shape (elongations) and frequent double growth. It is believed that these differences can be attributed to the younger physiological age of the immunized plants. Whether that is actually the case will only be determined next summer during the second phase of the experiment, Pia Malnoe explained. Still other outstanding questions, for example, with respect to possible taste differences, would also be clarified in the further course of the experiment.

Since the experiment took place outdoors, strict isolation measures were undertaken, to make any transmission of the virus gene to other plants very unlikely. Uncertainties exist as to the possibility of microorganisms in the ground acting as transmission mechanisms. A special experiment conducted in the greenhouse could not verify this possibility. While that is reassuring, it still does not provide a complete guarantee. Further information could be provided by earth samples, taken before and after the field experiment. If and when such a study is undertaken remains open.

Alexandre Vez also pointed to some future prospects that might be considered upon the successful conclusion of this first field test (in Switzerland) with genetically altered plants. The immunization method could be applied to other promising potato varieties, and to other kinds species like grapevines, fruit trees, berries, beets, and other trees. Genetic immunization presents itself as an alternative to chemical means of plant protection and might also serve in the struggle against certain tree diseases. However, Alexandre Vez estimates that it will be at least eight to 10 years before practical large-scale applications can be tried.

The environmentally concerned organizations Greenpeace and the Basel Appeal Against Genetic Engineering have accused the Swiss Research Facility Changins of ignoring possible dangers.

### Method for Economical Ethanol Production Developed

92WS0186A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 28 Nov 91 p 8

[Article: "Cheap Bioethanol from Triticale: Further Increase in Yield Through Amylase Addition Possible"]

[Text] Frankfurt—It is possible to do without the addition of expensive technical enzyme compounds in ethanol production if triticale is used to ferment the mash. Food chemists from Hohenheim University have demonstrated that it is possible to obtain ethanol from potatoes and maize with high yield by adding triticale. The process is therefore interesting for the technical production of cheap ethanol from renewable raw materials.

Triticale is a fairly new variety of cereal which was produced from a cross between wheat and rye. Triticale grains are distinguished by a high starch content and by the possession of unusually high autoamylolytic or starch-splitting enzyme activity. These enzymes break down the triticale's own starch very efficiently into sugar components. The researchers at Hohenheim discovered that it is also possible to use the amyloses from triticale to break down starch from other sources, such as that in potatoes and maize, very efficiently into sugar residues, which can then be fermented to form alcohol.

If 50 percent triticale is added to maize mash, or a quarter of the total in the case of potatoes, a high level of sugar conversion of the starch and alcohol yields of 65 IA/100 kg can be obtained without any addition of enzyme compounds. The scientists write in the professional journal for the laboratory (Fachzeitschrift fuer das Laboratorium, Vol 10, p 1087) that this should be considered a very good result—even for industrial standards the yields are on this order of magnitude.

Since the level of amylolytic enzymes does not depend only on the type of triticale, but can also vary depending on the location and the growth conditions, the enzyme activity of triticale is sometimes insufficient for optimal alcohol yields. In the experience of the researchers, the conversion of starch can be significantly improved if the amylase of *Bacillus licheniformis* is added to the mixture. Since this bacterial enzyme is not very expensive, adding it to the triticale to achieve high alcohol yields may still be economical.

### Germany: Microencapsulation Technique Developed

92WS0186B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 28 Nov 91 p 8

[Article: "Hollow Microspheres Make Biotechnical Processes More Economical: New Materials Make the Capsules Mechanically Highly Durable; Low Resistance to Diffusion and High Biological Compatibility"]

[Text] Frankfurt—A new method of cell encapsulation has been found by scientists from the Berlin Technical University. The so-called hollow microspheres can be used to immobilize bacteria and higher cells, and can raise the yield of the biotechnical products of these cells. The process was developed by the Institute for Biotechnology (TU Berlin, Seestrass 13, W-1000 Berlin 65) under the direction of Professor Rainer Buchholz, in cooperation with the Institute for Polymer Chemistry (Kantstrasse 55, O-1530 Teltow) and Halle-Wittenberg University (Weinbergweg, O-4020 Halle).

According to information provided by certified engineer Ralf Wiesmann of the Berlin TU, scientists have succeeded in recent years in enclosing delicate biological materials, such as cells or enzymes, with the help of microcapsules. Most of these processes are based on the formation of non-water-soluble polymer networks on the surface of a drop. The result is a capsule which contains the biological material. In this way cells can be immobilized, which can be advantageous for many biotechnical production processes. But according to Wiesmann the systems used previously to encapsulate microorganisms did not involve hollow spheres, since most of the volume of the capsule was taken up by the polymer membrane. Thus only relatively few cells could be enclosed, and the capsules had a low level of efficiency.

In addition, he said that the conventional capsules were mechanically very fragile because of the materials used (calcium alginate and carrageenan). This limited the capsules' usefulness. They were not suitable for production processes in agitated bioreactors, since the shear forces were too high. The Berlin scientists therefore used other materials in developing the hollow microspheres, a combination of sodium cellulose sulphate and polymethyl diallyl ammonium chloride.

The hollow spheres made from these materials turned out to be mechanically highly durable, have low resistance to diffusion and good biological compatibility. If there are cells to be encapsulated, the cell suspension is first introduced into the sodium cellulose sulphate solution. Then the mixture is dripped into a precipitant bath containing polymethyl diallyl ammonium chloride, where the hollow spheres form and harden. Then the hollow spheres are washed and transferred to the working medium.

The process was given its first practical test in cooperation with Halle University. Here the continuous production of citric acid and 2-oxo-gluconic acid was successfully accomplished. Further applications include processes with animal cells. Many medical and immunological products can be formed only from these cells. Yet animal cells in particular are often mechanically very fragile and are destroyed in reactors by shear forces. The cells could be protected from these dangers by encapsulation in hollow microspheres, he said.

Hollow spheres can also be used in waste water technologies. Biotechnical waste water treatment often produces

problem materials like halogenated carbohydrates, which can only be broken down by special bacteria. But these organisms grow very slowly. With the help of hollow microspheres, they can be retained in waste water treatment plants and raise the decomposition rate of the problem materials.

Furthermore, the Berlin process can be used for the continuous removal of a biotechnical product from a bioreactor (in situ extraction). Here the hollow spheres can hold back the biomass. He said that this technology is also advantageous from the point of view of safety. Encapsulation of microorganisms prevents expansion into the medium, and thus can replace expensive security measures.

### **German Government Reduces Funds for AIDS Research**

92MI0199 Bonn *DIE WELT* in German 18 Dec 91  
p 23

[Text] The German AIDS Help charity will have to stop work in 1994 if the Federal Government goes ahead with its planned cuts in financial support, representatives of the Federation of Regional AIDS Help Branches told the press in Bonn yesterday. The Federal Government's medium-term budget allowed only 3 million German marks [DM] to support the educational work of AIDS Help and the Federal Center for Health Education in 1994. DM30 million were earmarked for AIDS prevention in 1992 and DM16 million in 1993.

With 3 million in 1994, "we could only clear our desks and turn the light out," said Deutsche AIDS Help press officer Michael Lenz. "Sometimes we think the Federal Government is not aware of AIDS-related problems." There are currently an estimated 70,000 HIV-positive people in the Federal Republic and 7,000 suffering from the fatal immune deficiency disease.

The representatives of AIDS Help, the national association of self-help organizations for those infected and homosexuals, spoke out against any tightening of the rules on compulsory registration for AIDS demanded by the doctor's organization, the Hartmannbund. Only two days before, the Chairman of the German Federal Medical Council, Dr. Karsten Vilmar, had also spoken out against tightening the rules on compulsory registration, saying it would create a false sense of security.

AIDS Help demands also include long-term financing for their work with patients and risk groups. Another aim is that AIDS sufferers held in penal establishments could be released. The congress delegates are also calling for drug use to be no longer punishable and for prostitution to be recognized as a profession.

Social problems will be to the fore at the second Federal Meeting of Sero positives, persons with HIV and AIDS, starting Thursday in Bonn. Around 300 patients are

intending to travel to the four-day meeting. Workshops and talks with politicians from all parties are on the agenda.

A documentation center on social and individual discrimination against the HIV-positive will also be set up. According to AIDS Help, one quarter of sufferers in German cities are homeless. Some of them were given notice to leave by their landlords only after the illness developed. In Berlin, the Senate is refusing to fund two of the Federal Republic's total of 16 special nursing services. AIDS Help itself is unable to finance them. "It is now up to the Land of Berlin," said Lenz.

### **French Scientists Examine Effects of Neurological Toxins on Mammalian Nervous Systems**

92WS0216C Paris *LE MONDE* in French 11 Dec 91  
p 17

[Article by Catherine Vincent: "At the Heart of the Venom"—first paragraph is *LE MONDE* introduction]

[Text] The study of animal toxins provides a better understanding of how the nervous system works.

In the small village of Rosans (Hautes-Alpes), the 500 venomous snakes and scorpions of the Latoxan company are doing just fine. Well fed, raised under draconian hygiene conditions, they are weighed and cared for every week. All is quiet also in the nursery, where young snakes hatch normally. The "milking" of the livestock, in a few days, is the only operation that will require a general mobilization: performed according to a monthly rotation schedule, venom collection still requires rigorous know-how; for the past 10 years, it has been the main money-maker of the company, one of the first in France to specialize in the production and distribution of animal toxins.

Among its best clients, Latoxan counts researchers from the National Center for Scientific Research (CNRS) and the Atomic Energy Commission (CEA), whose research is among the most sophisticated in modern biology.

Their objective is to understand, perhaps even alter the action of these toxic substances, which are often paralyzing and sometimes deadly; to identify their molecular structure and their targets in the nervous system, in order to develop more effective and more specific antidotes with no side effects. With many other industrial and medical prospects in the bargain; these will be discussed at length at the International Symposium on Biology<sup>1</sup>, organized for the first time by the CEA directorate of life sciences, on 12-13 December in Saclay (Essonnes).

This ambition, certainly, is nothing new. The chemist Lucien Bonaparte, the brother of Napoleon and an expert on the 'Vipera berus' species, was among the first to obtain large fractions of viper venom through precipitation in alcohol. And Claude Bernard, studying the frog's neuromuscular system, was already researching

the effects of curare, the poison used for centuries by South American Indians to spread "flying death" with the tips of their arrows.

Since then, however, the experimental approach has taken on a new face. To study the effects of an animal toxin, there is no longer any need to inject poison into an unfortunate guinea-pig, to observe its effects in toto, or to perform a painstaking dissection to attempt to trace it in living tissues. From now on, the modes of action of venoms are expressed in terms of "cell membranes," "receptors," and "ion channels." Their analysis is done mostly on a computer display, and it takes the explorers to the very heart of proteins, the molecules essential to life.

Nature being generous, there are as many different venoms as there are snakes supposed to be dangerous to man: at least 400 species, to which should be added up to 100 scorpion species. In addition, to immobilize their prey, all these species use several paralyzing toxins, all with different chemical compositions.

#### "Curarizing" Toxins

How, then, can we hope to develop antidotes against each of these substances? By studying their targets. More or less directly, most of them exert their action on acetylcholine, an essential mediator of the neuromuscular system which, when released by a nerve cell, causes the corresponding muscle to contract. To hinder this vital mission, toxins have a wide choice. Some, the so-called "curarizing" toxins, act very selectively downstream from the neuromuscular junction by binding to the acetylcholine receptor. Others work upstream: they prevent the release of acetylcholine, or on the contrary increase it so as to fully saturate all its receptors.

No matter at what point between the nerve and the muscle the transmission of the nerve impulse is stopped, the subsequent paralysis also involves another category of biological structures: the ion channels. These are fine structures that go through the membrane surrounding any living cell; the Germans Erwin Neher and Bert Sakmann were awarded the 1991 Nobel prize for medicine for their research on these channels, whose role is to allow or prevent the exchange of ions (calcium, potassium, sodium, etc.) between the cell and its environment.

"Just as you can determine the personality of human beings by listening to them, the specificity of living cells can be recognized through their ion channel combinations," Michel Lazdunski, one of the top French experts in the field,<sup>2</sup> explained. Indispensable to cell life, these channels, among other things, play an essential part in the propagation of nerve impulses and in the contraction of muscle cells. It is therefore easy to understand that they are the targets of many animal toxins, such as most of the substances contained in scorpion venoms.

Based on this overall knowledge, the researchers' approach becomes clear. Toxins, neurotransmitters, receptors, and ion channels: all these molecules belong to

the same family, the protein family. To determine where and how they work, researchers must continue their exploration inside these macromolecules. Access to the heart of these infinitely small structures is now possible thanks to the tools of what is called "protein engineering." This is a field in full expansion, to which all developed countries are now devoting large research budgets, and which offers considerable economic, medical, and industrial prospects (see box).

To understand what it is all about, you should know that a protein is a macromolecule consisting of elementary "building blocks," the amino acids. They are linked into a linear structure, the so-called "primary" structure. But once a protein has been manufactured by a cell, it does not remain inactive. Depending on the electric charge of its atoms, it unfolds in space, twists, and coils itself until it has assumed its final form. It then acquires its "tertiary" structure which in turn will determine the protein's biological functions.

To grasp the functional characteristics of a toxin, therefore, you must know its structure in space and locate in its complex architecture the key positions that determine its action. As part of the Protein-2000 project started in 1988, the CEA has just set up a department of protein engineering and research (DIEP): a technical platform unique in France and, as its name indicates, entirely dedicated to this kind of research. Divided between Saclay and Grenoble, some 100 CEA researchers are working on it full time. To carry out their research, they have an annual budget of 30 million francs [Fr] and two highly effective analytical methods, crystallography and nuclear magnetic resonance (NMR).

"These two techniques complement each other," Andre Menez, DIEP director and former head of the CEA toxin laboratory, explained. "The older one, crystallography, is the only one that can absolutely provide access to the atomic structure of a molecule. But it implies that you must obtain the protein in crystal form, which is time-consuming and sometimes impossible. NMR is less accurate and applies only to small-size proteins. But it enables you to study the structure of the molecule in solution, i.e. in a form that is far closer to biological reality than the crystal form." In both cases, molecular graphics software programs are then used to display on a computer screen the surface, the volume, and the thousands of atoms of the proteins studied; they can also distort them and link them together at will through modeling.

#### An Amphibian Species

"In most cases, a few milligrams of a purified toxin are enough to decode its atomic structure," Flavio Toma, head of a DIEP laboratory, indicated. At molecular scale, this means a considerable amount, which explains why protein researchers sometimes turn into explorers. Doggedly hovering over holes in the rocks that surround Pacific islands, they then drive out hundreds ("sometimes within one day") of specimens of the amphibian

species 'Laticauda,' a sea snake particularly prolific in these regions. After that, all it takes is dexterity: a plastic tube attached to both venom fangs, a slight pressure of the hand on the venom glands... and the snake is released in nature. Biologists thus avail themselves of trips abroad to bring back minute amounts of the precious venoms ("a few microliters per animal"), when they do not call on businesses specialized in the production of toxins, or on the stocks of the Pasteur Institute.

Through the studies devoted to them, venom toxins already represent an irreplaceable model to understand the subtle mechanisms that control the transmission of nerve impulses. To design more efficient anti-venom serums, or even new anesthetics that would mimic the effect of these toxins while attenuating it, researchers must go still further. For each toxin, they must now determine the relation that exists between its structure and its function, localize its action sites, identify the molecular receptor to which it attaches in the nervous system. Tomorrow, they will have to modify its architecture through chemical synthesis, or again through controlled mutagenesis, acting directly on the gene that controls its production. They have only just begun.

[Box, p 17]

### The Cost of Proteins

They transport oxygen in the blood, catalyze chemical reactions in cells, protect our body against outside aggressions, control relations among our various organs. Hemoglobin, enzymes, antibodies, or hormones, proteins are ever-present in all living organisms. Because we can now alter their structure and improve their functional characteristics, they also represent a huge medical, agronomic, and industrial market, which is expected to reach an estimated Fr300 billion worldwide by 1995.

Within a few years, most industrialized countries have joined the race. The British started in 1985 with the Protein Engineering Club (PEC) which now has a budget of Fr35 million over four years. At the Japanese university at Osaka, the Protein Engineering Research Institute (PERI) was created in 1988 (Fr750 million over 10 years). In the United States, the first research center entirely dedicated to protein research opened in Maryland in 1989, and similar institutes are now being built in several other states.

In this context of high competition, France's strategy relies on two research organizations: the CEA, whose "Protein 2000" project was launched in 1988 (annual budget: Fr30 million), and the CNRS, where the interdisciplinary project IMABIO (Biological Macromolecular Engineering) was initiated in 1989 (annual budget: Fr165 million). The result of this dual operation, the future Structural Biology Institute (IBS) of Grenoble will open its doors in 1992. Financed equally by the CNRS and the CEA (Fr50 million for its construction) and entirely dedicated to protein research, it should eventually have close to 200 researchers.

### Footnotes

1. International Symposium on Biology: "Receptors, ion channels, and their ligands," Paris-Saclay, 12-13 December 1991.

2. Director of the Molecular and Cellular Pharmacology Institute of Sophia-Antipolis (Nice), Michel Lazdunski was awarded the 1991 price of the Athena Foundation-French Institute on 3 December, for his contribution (essentially the result of his research on ion channels) "to the study of the mechanisms of certain affections and the discovery of new medical drugs."

### European Approval of Genetically-Altered Mouse to Benefit Cancer Research

92WS0225C Paris LE MONDE in French 13 Nov 91 p 16

[Article by Catherine Vincent: "Myc-Mouse Patented in Europe"—first paragraph is LE MONDE introduction]

[Text] After six years of debate, the European Patent Office has just approved a genetically-altered mouse.

It was a Kafkaesque case, its conclusion will go down in history: after years of shilly-shallying, the European Patent Office (EPO) in Munich just granted, for the first time, a patent authorization covering a genetically-altered mammal. A white mouse that looks like any other white mouse but could be of considerable medical interest. That is because its chromosomes contain a gene involved in cancerization, so that this "transgenic" mouse (into which a foreign gene was introduced) and its offspring are "programmed" to develop a cancer.

Flashback—In 1984, two American researchers at Harvard University, Philip Leder and Timothy Steward, announced that they had "grafted" the myc gene (an oncogene identified a few years before) onto the genome of a mouse. Molecular biology laboratories had only just begun to develop the so-called "transgenic" method that the researchers had used. Four years later, on 12 April 1988, the U.S. Patent Office decided to take the plunge: because Myc-Mouse offered a novel and promising way to study breast cancer, it became the first higher animal to be legally considered man's property in America (LE MONDE, 18 May 1988).

Caught unprepared by the quick U.S. decision, the European Patent Office in turn started to consider Myc-Mouse. But this time the application (filed under No. 85,304,490.7) vastly exceeded the scope of industrial protection. "If we agree to patent a mouse, aren't we going to do the same tomorrow for a human embryo?" experts on ethics worried. From the patentability of genetically-altered microorganisms (accepted since 1980) to that of a mammal, it is a huge step. And the Harvard case suddenly brought to light the flaws and contradictions of the European legislation concerning

"the law of living organisms," now made obsolete by the lightning progress made in recent years by genetic-engineering techniques.

Should Myc-Mouse be patented? "No," the European Patent Office decided in July 1989. In support of its refusal, the examination division referred to Article 53 of the Munich Convention (1978), which states that patents can be delivered only for "vegetable varieties or animal races, and the essentially biological processes used to obtain vegetables or animals." Already then, however, the EPO estimated that such inventions are not, to quote the law, "contrary to law and order or to accepted moral standards"—in other words, contrary to the values commonly accepted by society.

#### For the Good of Mankind

In October 1990, the first sudden new development occurred. At the request of the U.S. company DuPont de Nemours (the exclusive licensee of the Harvard mouse), the EPO appeals chamber invalidated the prohibition decision. This forced the examination division to reopen the case; actually, it fully reversed its prior conclusions. Article 53, it stated, should be reinterpreted in the light of "subsequent circumstances and developments."

From the point of view of "accepted moral standards," the appeals chamber of the EPO estimated on the other hand that further analysis was required as well as a reassessment of the balance between the suffering of animals genetically programmed to develop a human disease, potential risks to the environment, and the usefulness of such a model for human medicine.

The examination division therefore redid its work, and last October it published a text officially approving the patentability of Myc-Mouse in 14 European countries<sup>1</sup>. In it, the EPO again stated that Myc-Mouse poses no threat to law and order, as it might "facilitate cancer research and the fight against such diseases" and thus be of "higher interest for the good of mankind." As for Article 53 of the 1978 convention, the Munich EPO also stated the principle that "new techniques may not be denied patent protection, even though they may involve some risks." It estimated that "each case should be decided based on the concrete elements that characterize it," adding that "the industrial conditions of this invention (Myc-Mouse) should however be set by law."

True, the case is not quite closed. Opponents to the EPO decision, including European associations for the protection of animals, have nine months to file an appeal before the final decision is made; we can therefore still look forward to some nice nitpicking debates. But there is little doubt that the conclusion will be in favor of the patentability of the Harvard mouse.

Tens of transgenic animals are now being engineered each year in medical or agronomic research laboratories, and pharmaceutical, chemical, and agrifood manufacturers are beginning to take a very close look at them (LE

MONDE, 26 June 1991). Behind the specific Myc-Mouse case, therefore, loom considerable economic stakes, on which depends in part the place that Europe will take tomorrow in the field of biotechnologies. Unwilling to create a precedent, the EPO examination division pointed out that the authorization it just delivered "applies exclusively to the case of the Harvard oncogenic mouse," thus reserving the right to "arrive at different conclusions" in other cases involving transgenic animals.

This precaution takes the value of a symbol at a time when the European Parliament is preparing to vote on a draft guideline concerning the legal protection of biotechnological discoveries. A guideline in which the European Community Commission already pronounced itself in favor of the patentability of "all biological categories," with the exception of groups that may be considered as "races, varieties, or species."

#### Footnotes

1. The European patent convention currently applies to the following countries: Germany, Austria, Belgium, Denmark, Spain, France, Great-Britain, Greece, Italy, Liechtenstein, Luxembourg, The Netherlands, Sweden, and Switzerland, to which Monaco and Portugal should be added in the next few months.

#### Switzerland: ETH Scientists Develop Microprojectile for Genetic Transfer

92WS0242C Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 19 Dec 91 p 8

[Article by "bh": "Genetic Transfer in Plants Through Microprojectiles; Swiss Researchers Expect Applications in Many Tissues; Initial Experience With Tobacco Cells"]

[Text] Frankfurt—The problem that still exists with respect to altering plants through genetic engineering is that none of the methods tested thus far can be applied to all types of plants with an equal degree of success. For this reason, researchers at the Swiss Technical College [ETH] in Zurich have tried to improve the so-called gene cannon used for genetic transfer. They have scaled down the rather rough projectiles with which the cells are bombarded, and can now provide certain tissue with a desired gene very effectively and with a high yield. The scientists hope that they will be able to apply the method to many different tissues and types of plants.

Many plant researchers consider the ballistic method for transferring genes to plant cells to be the most promising method at present for altering certain tissues in the living plant in situ through genetic engineering. Since there is frequently a desire to transplant genes into meristem tissue or embryonic tissue, the problem that arises is that the cells are often very small and densely packed. When bombarding, one must then choose a correspondingly high particle density in order to achieve an efficient cell

transformation. In the past, scientists have loaded tiny gold or platinum particles with gene molecules and bombarded the target cells with them at high speed. However, the particles were often still so rough that they seriously damaged the cells. In addition, the gene molecules entering the cells at high speeds often broke up.

For this reason, C. Sautter and his colleagues from Zurich modified the ballistic method in such a way that the DNA molecules fly into the cell separate from the gold particle. The metal particles, which have a diameter of only around one micrometer, make tiny holes in the cell walls, and at the same time allow the undisturbed entry of the gene molecules into the cell, like stowaways. The researchers charged the gas phase (carbon dioxide or nitrogen) in an airgun with gold particles, which were accelerated there in a steel capillary. At the end of the capillary a drop of DNA solution is atomized into a mist. The tiny drops of this mist are forced together with the gold particles, which are about the same size, through a minuscule glass channel, and in the process they are further accelerated. In this so-called Bernoulli stream, the particles and the drops containing DNA are accelerated to such a speed that they penetrate the target cells with high efficiency.

According to the experience gathered by the researchers, the conditions for the new microprojectile can be chosen in such a way that foreign genes can be stably inserted in plant cells with high yield. With tobacco, they have achieved a stable transformation in one out of a thousand exposed cells. Such a high yield has been achieved with the macroprojectile in cells that expressed the foreign gene only temporarily. It has proven to be especially helpful with the new method to use linear instead of supercoiled DNA. Thus far, however, it remains unclear whether the microprojectiles will be able to deposit foreign gene molecules this effectively in anything other than tobacco cells.

### **British Scientists Treat AIDS With Anti-Herpes Drug**

#### **Anti-Herpes Drug Found to Treat AIDS**

92WS0245E Paris LE MONDE in French 31 Dec 91  
p 20

[Article by London correspondent Laurent Zecchini: "According to a Group of British Researchers, Acyclovir Would Have Positive Effects in AIDS Treatment"—first paragraph is LE MONDE introduction]

[Text] According to the SUNDAY TIMES of 29 December and the TIMES of 30 December, a research team of British physicians has discovered that Acyclovir (a drug prescribed to herpes and herpes zoster patients), in association with other drugs, can reduce the mortality rate among victims of the AIDS virus.

Close to 300 patients affected by the HIV virus were treated with Acyclovir in Great-Britain, in Germany, and in Australia; the success was such, it seems, that a

decision was made to administer the treatment to the patients who, under the experiment (supposed to last three years), were not taking the drugs.

The TIMES, which published details of the discovery, quoted Dr. Griffiths, professor of virology at the London Royal Free Hospital and one of the authors of the Acyclovir testing program, as saying that this is "a first step toward a new era in AIDS treatment." If the initial results are confirmed, this discovery might prove as important as that of AZT five years ago. AZT is the only antiviral drug that, until now, has been used and recognized throughout the world to slow down the progress of the disease. Treatments based on AZT (azidothymidine) and Acyclovir—two drugs produced by the British company Wellcome—both benefit the patients.

Together, they would, so to speak, attack the virus on two fronts. According to the tests performed, 20 percent of the patients treated with AZT alone died during a one year period, while only 10 percent of the patients treated with both drugs died.

What is the explanation for the effectiveness of this treatment? The cytomegalovirus (CMV), which is a type of herpes virus, is believed to activate the immune system, and therefore the AIDS virus when the latter is still at a latent stage in the organism. According to Dr. Jean-Claude Chermann, co-discoverer of the HIV virus, Acyclovir, "by preventing the stimulation of the immune system, would at the same time block the AIDS virus."

Contrary to AZT, Acyclovir is a "soft" drug with few side effects. The cost of Acyclovir treatment is estimated at about 5,000 pounds (50,000 francs) per year. However, Dr. Brian Gazzard, medical coordinator of AIDS treatment at the Westminster hospital, was careful to point out that this discovery is part of the progress achieved in the fight against AIDS but does not constitute per se a remedy against the virus.

### **Scientists Terminate Experimental Use of Anti-Herpes Drug**

92WS0261C Paris LE MONDE in French 5-6 Jan 92  
p 7

[Unattributed article: "End of Acyclovir Testing on AIDS Patients"]

[Text] The British pharmaceutical group Wellcome announced on Friday 3 January that it had ended the experiment started two years ago, in which 300 patients carrying the AIDS virus were treated with Acyclovir.

On 28 December 1991, the researchers announced that the experiment showed that Acyclovir in combination with AZT—the only drug recognized until now to control the disease—would slow down the development of the HIV virus in seropositive individuals (LE MONDE, 31 December) by attacking it on two fronts. These "encouraging" results will continue to be "carefully considered," a spokesman for Wellcome indicated. But

the initial objective of the "double blind" experiment carried out for two years in Germany, Australia, and Great Britain, was to identify the beneficial effects of Acyclovir on the cytomegalovirus (CMV), one of the agents causing herpes, which is often present in AIDS patients. These tests did not yield any significant result and were ended on 31 December 1991.

### Swiss Firm Enters US Biotechnology Market

92WS0261D Paris LE MONDE in French 19 Dec 91  
p 34

[Unattributed article: "Sandoz Gains a Foothold in Biotechnologies"]

[Text] Out of favor after a period of euphoria, biotechnologies are making a strong comeback. While Ciba-Geigy, the leading Swiss producer of medical drugs, decided to set up its biotechnological center at Huningue (Haut-Rhin), at a cost of 700 million francs [Fr], its Swiss rival, Sandoz, the 12th pharmaceutical group worldwide, just put up \$393 million (Fr2.11 billion) to acquire a 60 percent controlling interest in the California laboratory SyStemix, a world leader in immunology and the holder of a recent patent covering the separation of original cells from human bone marrow. In the next three years, Sandoz will have an opportunity to increase its participation to 100 percent. Last year, Hoffman-La Roche (Switzerland) spent \$2.1 billion (Fr11.3 billion) to take over first Genentech, and then part of Cetus. American Home Products followed suit by acquiring Genetics Institute for \$666 million (Fr3.6 billion).

### Switzerland: Self-Replicating Nucleic Acids Developed

92WS0267A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 17 Dec 91 p 8

[Article by "bh": "Self-Replicating Micelles Possible; Research Group Successfully Uses Sodium Octanoate; Search for Membranes"]

[Text] It is increasingly common for bioengineers specializing in evolution to study living systems in the hopes of discovering principles that can be used to synthesize chemical products. Researchers from Strasbourg and the University of Zuerich have now succeeded in producing self-propagating micelles. Professor Manfred Eigen, of the Max Planck Institute of Biological Chemistry in Goettingen, succeeded some time ago in producing self-replicating nucleic acids, which multiply without the help of enzymes and presumably played an important role in biological evolution.

It is apparent, however, that there are other classes of self-propagating molecules besides the nucleic acids used by nature for the storage of genetic information. The

Swiss-French research group used an organic polar molecule, sodium-octanoate, to produce their self-replicating system. The octanoate, which had been oxidized into a polar acid by using permanganate of sodium, forms a layer on the micelles, which themselves consist only of a single simple molecular layer.

This polar acid group is located on the surface of the artificial membrane, which has been immersed in water. Inside the micelle is a hydrophobic space, which the researchers filled with the alcohol 1-octanol. In the interior of the micelle, chemical reactions take place which result in new micelles, but this ceases when supply of raw material in the interior is exhausted.

The researchers are therefore searching for ways to provide a continual supply of new raw material to the interior of the micelles. This problem has been solved in living systems by the formation of a double membrane, on either side of which is an aqueous medium. The reacting agents are dissolved in this medium, and either can diffuse freely from the exterior to the interior, or are passed through special openings. The chemists should hardly find it an insurmountable task to produce a similar synthetic membrane.

### Computers

### Dutch Universities Merge Computer Research Activities

92AN0098 Amsterdam COMPUTABLE in Dutch  
15 Nov 91 p 2

[Article by Mark Plekker: "Technical University of Eindhoven and State University of Utrecht To Combine Research Efforts"]

[Text] The Netherlands still has a long way to go as far as the formation of major research groups of computer scientists is concerned. The creation of a joint research organization consisting of the computer science research groups from the universities of Utrecht and Eindhoven is the first indication of a possible increase in scale.

Last week, the Dutch Organization for Scientific Research (NWO) announced the names of the 13 university research institutes which will be granted about 1 million guilders in subsidies each for performing advanced research. Computer science research was not included. Computer scientists in the Netherlands were too divided among themselves to come up with a research initiative which stood a chance of gaining the research millions.

At present, the most advanced initiative in which research capabilities are merged is apparently the Eindhoven-Utrecht Research Institute in Computing Science (EURICS). The future research manager of this scientific institute, Prof. J. van Leeuwen, expects that the governing bodies of the Technical University of Eindhoven

(TUE) and the State University of Utrecht (RUU) will formally ratify the cooperation agreement in the next few weeks.

EURICS was created with the purpose of merging the research activities of the TUE and RUU. The new institute includes the research groups of eight professors, five from Eindhoven and three from Utrecht. A total of 35 scientists will perform research within the framework of EURICS.

According to Van Leeuwen, the creation of larger research units is "the inevitable path to be taken. It is becoming clear that in the future the financing of research will occur exclusively through research institutes." According to Van Leeuwen, the fact that the scientists from Eindhoven and Utrecht, unlike most of their colleagues in the country, were able to agree on a cooperation framework is due to "the understanding that there was a similar approach to computing science education and research in Eindhoven and Utrecht."

But there are also differences in priorities. The information scientists of the RUU focus on the basic aspects of research, on theorization, and on the development of enhanced design methods. According to Van Leeuwen, the TUE traditionally combines mathematics, computing science, and technology. "They are, for instance, very strong in the field of formal methods." The EURICS research institute links the theoretical approach of the RUU to the application-oriented approach of the TUE, says Van Leeuwen. "We are bringing together researchers who study the same research area from different angles." Van Leeuwen quotes the design of efficient algorithms, design studies, and the development of protocols for distributed systems as examples of research fields covered by EURICS.

The future manager of EURICS promptly adds that he has no rigorous, firm claims regarding the research fields to be covered by the institute. He says so because he does not want to interfere in advance with the attempts of the Dutch Computing Science Research Institute (SION) to promote the creation of computing science institutes on a national scale.

To put an end to the discord among computer scientists, SION is cautiously trying to bring groups of computer scientists onto the same wavelength. For this purpose, their specialty was subdivided into three subareas: computer systems, programming systems, and information systems. It is to be determined whether research cores can be formed around these clusters.

Says Dr. R.P. van de Riet, who coordinates this national reconnaissance mission on behalf of SION, about EURICS: "It is the most concrete form of cooperation. I would not be surprised if this cooperation should eventually be a success. We at SION also believe that major research groups can only be formed if groups of computer scientists first work together on a smaller scale."

Van de Riet anticipates that it will take another two years or so before a really large research institute for computer science will exist.

Van Leeuwen follows the developments within SION closely: "We participate openly in this discussion. We do not want to halt other initiatives with EURICS." But, he admits, he will not allow himself to be stalled because other scientists are unable to come to terms with each other. "Everyone has had plenty of time to come up with initiatives."

#### Switzerland: National Computer Center Uses NEC Supercomputer

92WS0128A Zurich NEUE ZUERCHER ZEITUNG (INTERNATIONAL EDITION) in German 8 Nov 91 p 28

["National Computer Center in Tessin in Test Operation"]

[Text] *The first test phase of the new, high-performance NEC SX-3/22 computer at the Centro svizzero di calcolo scientifico (CSCS) in Manno near Lugano, which has been in operation since 30 September 1991, was brought to a successful conclusion during the last week of October. Regular operation of Switzerland's and the CSCS' most powerful supercomputer can therefore get underway on schedule during the first quarter of 1992 in its capacity as national computer and service center for special university studies and private interests.*

ru. Lugano, 5 November The high-performance NEC SX-3/22 computer, produced by Nippon Electric Company (NEC), France, and now available to the Swiss research community, theoretically has—according to its operators—more than twice the capacity of the most efficient computers now operating in Switzerland and is, at the same time, the fastest computer in Europe. In the fast-moving world of EDP, such superlatives only remain valid for a short time.

In the professional jargon, the special qualities of the 24 million Swiss franc computer in Tessin is described as follows: The SX-3/22 in its initial configuration has more than two central calculators with a theoretical maximum performance of 2.75 billion floating point operations per second (GFlops), a central memory for a billion information units (1 GByte), which will be doubled at the end of the year, as well as a 4-Gbyte external memory and a 70-Gbyte disk. In addition, it has a robotized archive system on tape with room for another 1250 billion (1.25 Gbyte) information units.

#### External Adapters Possible Throughout Switzerland

Thirty work stations are available to CSCS users of the computer. Scientists throughout Switzerland, who are not in the center, can access the resources of the Tessin computer through the university and research information network. The initial transmission capability of the main connections between Manno and the technical

universities in Zurich and Lausanne is about 200,000 information units per second.

In its present size, which is designed for future expansion, the computer alone occupies an area of about 250 m<sup>2</sup>. In all, the CSCS Association has rented 4200 m<sup>2</sup> in a newly erected commercial building, owned by the Swiss Federal Railroad (SBB), in Manno's industrial zone. The center's interior (offices, training rooms, etc.) has been designed so that the computer enjoys maximum protection as will the planned extension. The heat generated by the computer is utilized to heat the entire building.

#### Successful Starting Phase

Within the framework of the first test phase, about a dozen Swiss scientists, supported by CSCS specialists and employees of the manufacturer, gained their first experience with the new computer. The first program applications, according to Dr. Fiorenzo Scaroni and Dr. Ralf Gruber, directors of the CSCS operation and system consultation sections and scientific applications consultation section, were completely successful.

The supercomputer has been put into operation primarily to calculate and simulate complex physical phenomena. This involves the investigation of mechanical structures, e.g., in cases involving aircraft or automobiles in extreme situations, as well as the study of molecular structures in quantum chemistry. Other scientific fields, which could profit from the new research capabilities, are climatology and fluid mechanics. Because of the complexity of the computed, diverse models, the conversion of the results into three-dimensional color graphics becomes particularly important. Special emphasis in Manno is therefore given to the graphics laboratory, in which the results can be effectively represented on paper and slides as well as being animated on video.

#### Process Optimizations

Owing to the new capabilities, Manno supercomputer specialist Ralf Gruber now expects advances in processing as well, e.g., with respect to improvement of the algorithms underlying the computations or in optimization of existing programs. In the present test phases, it is essentially a matter of having skilled users test the new facility with known programs. After adaptation to the SX-3 operating system, a "normal" run-through was made. The results were then analyzed and continually improved by means of special programs, which concurrently generated proposals for improvement. The purpose of this program is, among other things, to really utilize the great capacity of the supercomputer to the optimal degree. In the most exact conversion of real physical phenomena into calculable systems possible, this aspect, in addition to the possibility of increasing the amount of data introduced, likewise assumes central importance.

#### Broader Interests and Prospects for Tessin

CSCS services (computer use, consultation, guidance) in Manno are available primarily for Swiss scientists active in the indicated fields. But universities and private research institutes in Italy, Germany, and France have already expressed interest in participating. A longer range goal is to establish new research institutions in the vicinity of the CSCS and to facilitate and promote scientific projects in Tessin. The inviting spaciousness of the canton was the main reason that a site in Tessin was selected for the national computer center.

The fact that—following a halting initial effort—the national high-performance computer center project could be realized on schedule was anything but matter-of-course. The first steps were taken as early as 1986; a masterful planning and organizational effort on the part of all participants was required. Within the framework of the first "Information Science Packet" (Term: 1 October 86 to 30 September 91), the Federal Assembly approved a credit of 40 million Swiss francs for a "supercomputer of the latest generation." The Swiss Federal Institute of Technology in Zurich (ETHZ) was charged with planning and procuring the infrastructure required for the operation. Shortly before its completion, ETHZ aborted the first project, which had called for the erection of a center in Zurich, for a variety of reasons, including space considerations. In order to temporarily satisfy the continually increasing demand for great computer capacities, the existing high-performance computer system in Zurich's technical universities and Lausanne—each supplemented with a Cray super-computer—were first employed.

#### Good Results in the End

In 1988, ETHZ again assumed responsibility for the project. Its first decision was to select a new site in southern Switzerland. Owing to disputes in Tessin, it took about two more years before definitive planning of the center in the "Galleria 2" commercial building in Manno could be agreed upon. The complicated construction and technical infrastructures had to be planned and ordered in a relatively short time. A private general contractor was charged with the ongoing work. Advising him was the CSCS section of information science services of ETHZ, with Fiorenzo Scaroni, an electrical engineer from Tessin in charge, as well as an engineering office that specialized in the construction of computer centers. The basic facilities were finally erected in the spring of 1991. The computer evaluation group, consisting of about 30 representatives from various universities, had shortly before agreed on the procurement of a NEC product, thereby clearing the way to the home stretch and project completion.

The technical facilities (power supply, temperature control systems, security systems) now had to be selected to meet the specific requirements of the NEC computer.

The electrical supply to the entire technical infrastructure includes three 1000-kVA-connected-load, high-voltage transformers. The computer itself requires 250 kW. Another system, built and installed by a Tessin company, provides uninterrupted power to ensure disturbance-free computer operation.

On 23 September the NEC SX/3, packed in 110 crates totaling 110 tons, arrived in Manno. Five freight cars were required to transport the computer, which had arrived in Frankfurt from Tokyo by air, to Tessin. The 20 NEC specialists, who had accompanied the shipment, required two weeks to install the hardware and software. The Japanese technicians were finally able to turn now operations-ready supercomputer to the CSCS on 30 September, precisely at the end of the government-approved time period set down in the "Information Science Packet."

### **German Research Center Studies Artificial Intelligence**

92WS0201A Duesseldorf *HANDELSBLATT* in German  
5 Dec 91 p 40

[Prof. Dr. Gerhard Barth is Scientific and Technical Director, German Research Center for Artificial Intelligence GmbH (Deutsches Forschungszentrum fuer Kuenstliche Intelligenz GmbH), Kaiserslautern]

[Text]

### **Artificial Intelligence: Leading Firms Use the Services of a Kaiserslautern Institute**

#### **Synchronizing Business Research Interests With Basic Research**

The German Research Center for Artificial Intelligence GmbH (Deutsche Forschungszentrum fuer Kuenstliche Intelligenz GmbH, DFKI) is a private enterprise whose research focuses on basic problems of artificial intelligence and its industrial applicability. As a bridge between university and industry, the DFKI makes an important contribution to technology transfer in the "artificial intelligence" (AI) area of computer science.

The DFKI was founded in the summer of 1988 with headquarters in Kaiserslautern and a second site in Saarbruecken. This occurred at the initiative of the Federal Minister for Research and Technology (Bundesminister fuer Forschung und Technologie, BMFT) in order to make the Federal Republic of Germany competitive in this area of modern research and to be better able to respond to the demands and opportunities of the expanding market for AI technology.

#### **Findings are Given to the Partners**

Partners of the DFKI are Daimler Benz, the Fraunhofer Society, the Society for Mathematics and Data Processing (Gesellschaft fuer Mathematik und Datenverarbeitung), IBM Germany (IBM Deutschland), Insiders,

Krupp-Atlas Electronics (Krupp-Atlas Elektronik), Digital-Kienzle, Philips, Sema Group Systems, Siemens Nixdorf Information Systems (Siemens Nixdorf Informationssysteme), and Siemens. Contracts regulate collaboration with the universities of Kaiserslautern and Saarbruecken as well as with the BMFT. Thus DFKI personnel can hold lectures, assign thesis and project research, or obtain a doctorate and qualify as a university lecturer at one of the two universities. In return, university members can participate in DFKI research projects.

Economic prerequisites for the start-up phase were guaranteed in the contract with the BMFT on project-related funding. One of the most important tasks of the DFKI is to synchronize research interests of business with those of applied basic research. Moreover, results of academic research are transferred from the universities to the research and development departments of the partners. In the three years of its existence, the DFKI has undertaken 17 projects. In the process, the staff has increased from 12 to over 160.

The DFKI already enjoys an excellent scientific reputation due to numerous publications and honors as well as participation in expert committees. The balance sheet total in the years from 1989 to 1991: about 30 million German marks [DM].

All research projects carried out at the DFKI are oriented towards the theme "intelligent expert systems." Where artificial intelligence and traditional computer science border on each other or overlap, there the Institute's scientists try to close the gaps between purely basic and exclusively applied research. At present the focal points of research are:

- User-friendly interfaces for dealing with ever more complex computer systems: Along with the integration of graphics, animation, and video, communication with computers in natural language is an important feature.

#### **Expert Systems Geared Toward the Future**

In addition, systems must select and present information intelligently as well as offer help for both the beginner and the advanced expert.

- Real-time conditions in the application of intelligent expert systems demand a special and still largely unstudied presentation and deduction of expert knowledge. In industrial production, features like fail-safe operation, reliable and prompt reactions, self-adaptation to changing situations, and treatment of fuzzy knowledge are of the greatest importance.
- Current expert system technology attempts to simulate the abilities of human experts, especially through the acquisition and processing of knowledge. Furthermore, future expert systems should be able to orient their method of operation towards typical models for

the problem solving process, for example delegation or division of problems.

- Logical conclusions are a central component of all tools used in knowledge processing. With their help, new discoveries can be derived from known facts and then applied further by the system. The development and implementation of such mechanisms requires the discovery of new techniques for the acquisition and formalization of expert knowledge.
- In decentralized knowledge processing, so-called cooperating agents are being studied which, for example, represent independent expert systems and work together with knowledge-based systems on other nodes of a computer network in problem solving.
- In the office of the future, most information will be stored. AI systems support automatic preprocessing of papers which makes it possible to extract and use information as well as to help in deciding how a document is to be handled in the course of operations.

#### **France: Industry Ministry Launches CIM Program**

92WS0202D Paris ROBOTS in French 30 Nov 91  
pp 6, 7

[Article entitled: "CIM's Slow Progression in France"]

[Text] Despite being well-equipped in computer-integrated manufacturing, CAD, CAPM (computer-aided production management), and CAM (computer-aided manufacturing) modules, French companies still lag behind Germany when it comes to integrating and linking them up. That is why the Ministry of Industry is at it again with a new "Logic" procedure. The first program, which was launched in 1988, involved 5,200 companies that were given 130 (? figure not legible in fax, could be 430) million French francs [Fr] to purchase CAD, CAPM, and CAM software packages. The new "Logic Integration" program aims to help companies that want to make the leap into integration of their different computerized functions, including design, manufacturing, maintenance, and production or sales management. The program targets companies and manufacturing groups of fewer than 2,000 people. Funding is divided into two phases: preliminary studies and implementation. Up to 50 percent of the expenditures for preliminary studies (with a ceiling of Fr300,000) can be subsidized. Reimbursable loans are available for implementation (50 percent of consulting, training and engineering costs, and 30 percent of the price of software, with a ceiling of Fr1 million). Over 300 application files have already been received by the Regional Industry Directorates (DRIRE), which are responsible for managing the new Fr150 million program.

At this stage no one dreams of incorporating CIM into existing systems. Professionals talk about master plans or integration plans, and stress profitability over technique. Indeed, each company is a special case, and so its

CIM system cannot be found ready-made on the market. The solution must be designed with the user, who will select and integrate the different necessary components, if they are available on the market. Moreover, de facto standards, open systems, some new hardware, and software (work stations, relational data bases, networks, CAD interfaces, and so on) are moving toward the information sharing that is the basis of CIM. The drop in prices also plays a role. Standardization now allows manufacturers to estimate costs more easily, whether for a CAD work station priced at Fr200,000, or a flexible machining unit whose price can vary between Fr5 and 10 million depending on configuration. As a result, companies do react more swiftly with these tools: Today, halving the amount of time it takes to design and manufacture a product, providing an estimate in a matter of hours, or setting up a product-naming system that is common to the engineering and design department and the plant are tangible realities. CIM is now 80 percent "reactive." It also makes it possible to boost the level of personnel, with the result that one sometimes sees a company marketing a management system that it has mastered perfectly over time.

Successful implementation of CIM requires not only reorganization and new ways of sharing information, but changes in the criteria used to determine compensation as well. This point was recently underscored by Yves Lasfague, director of the Research Center of the French Management Institute, to our colleagues of TECHNIQUES ET EQUIPEMENTS DE PRODUCTION. Calculation of employee compensation is now based on five broad factors: time worked, personal productivity, job qualification, level of responsibility, and individual considerations. These factors need to be reexamined, for they have become causes of injustice and inequality in companies that are largely automated. The notion of compulsory performance is spreading: Ability, rather than presence, should be compensated. Qualification for the job is based increasingly on prompt diagnosis of problems and the ability to solve them rather than on the length of formal education and training. The tiniest error—insignificant 10 years ago—can cause substantial production losses. Thus, real responsibility no longer rests with management but with operators. Moreover, individual productivity must leave room for collective output. Yet, to conclude, nothing is set in stone: Integration like computer-integrated manufacturing in the broadest sense implies continual learning. Impressive theoretical schemas are dangerous. Companies must integrate step by step, weigh the risks, and foresee the effects on organization and personnel training. The exercise is as difficult as it is crucial: It is the competitiveness of companies that is at stake.

#### **FRG Hardware, Software Firms Called Struggling**

92WS0255A Duesseldorf WIRTSCHAFTSWOCHE  
in German 27 Dec 91 pp 68-70

[Article by Markus Hennes: "Computer Industry: Germany Lacks World Class"]

[Text] Executives in the computer industry currently have one question in particular on their minds: Will there still be an independent European data processing industry in the year 2000? After years of spectacular profits, the success-spoiled companies are in the throes of a difficult crisis. Almost all of them are operating in the red, from the French Bull group to the Italian Olivetti concern. Even the industry paragon, America's IBM, is in a bad way.

The companies are trying to improve their profitability through a rigid retrenchment program, mostly in the form of layoffs. Whenever this alone is not enough, strategic alliances are entered into. In Germany, the washed-out Nixdorf AG was merged with Siemens' data and information processing division, which had been sound as a bell, as early as in 1990. But the first fiscal year of the new Siemens Nixdorf Informationssysteme (SNI) ended in a loss of 780 million German marks [DM]. There is still no evidence of the much-touted synergetic effects (the company slogan: "Synergy at Work").

At the same time, German unification bestowed an intermediate boom on German manufacturers of office, information, and communication technology in 1991. By the end of the year, the demand for hardware, software, and services had increased by one-quarter to around DM90 billion.

The boom did not, however, cover up the problems of the domestic office and computer industry. In the future, these troubles are even likely to increase rather than decrease. Technologically behind and financially shattered, the Germans can scarcely survive in the struggle for market shares. Worldwide over-capacities and structural shortcomings in Germany threaten the existing production sites in the east and west of the republic. The shaken companies are taking the first logical steps under the circumstances. Investment is going into only the most necessary areas, and unprofitable jobs are being eliminated. The number of employees in the new Bundeslaender will decline in 1992 by 10,000 to only 15,000. The red pencil is prevailing in the computer sector of the old Bundeslaender as well: around 5 percent of the jobs here will be lost.

Franz-Josef Wissing, executive director of the Central Association of the Electrical Engineering and Electronics Industry (ZVEI), considers the competitiveness of German suppliers to be acutely threatened. In microelectronics and information technology in particular, there is a danger of "a monopolization of basic technologies" in Japan and the rest of the Far East. In electronic components, for example, Japan's world market share already amounts to 40 percent, according to Wissing, while the figure is as high as 80 percent for dynamic memory chips. Users such as machine-tool builders are also increasingly dependent on Asian know-how.

The concentration among hardware manufacturers is having its effect on the software industry. With respect to

the approaching internal market in particular, German software and services companies must enter into cooperative arrangements with one another and/or forge strategic alliances, even with unpopular American or Japanese partners. Only in this way can they assume a scale that will be competitive. Otherwise, German software and system houses, which are predominantly mid-size and frequently operate in market niches, run the risk of losing out on the international connection.

Two characteristics of the far-reaching structural transformation are the emergence of smaller, decentralized Unix systems or data networks with personal computers (down-sizing) and the trend towards open systems, in which the user can freely combine hardware and software components from various manufacturers. At the same time, software sales are outstripping hardware, and the market is developing into a massive business. Electronic data processing, says Manfred Frey, director of the IDC Deutschland market research institute, "currently shows all signs of a ripe market." They are no longer product cycles, but rather economic trends that are of critical importance to demand.

With more or less identical products—and that is true in particular of personal computers—additional benefits such as a brand's image effect are rapidly gaining in importance. Users are becoming more conscious of price; manufacturers must compensate for the decline in margins with larger quantities. Large quantities in turn make it necessary to concentrate suppliers, as well as to supply worldwide markets.

Still, nearly all computer companies in the old continent lack the preconditions for becoming a global player like IBM, Digital Equipment, or Fujitsu on their own. Hard-pressed on the domestic market, moderately present in Europe, and practically non-existent overseas, even SNI will probably have only a slight chance of surviving in the long run. SNI head Horst Nasko can come up with only scant consolation: "If all computer makers in Europe were to disappear, we would certainly be the last."

#### **Percentage Change in the Computer Industry From 1991 to 1992**

Western Germany: production 5.0; investment 2.0; employment -5.0

Eastern Germany: production 25.0; investment 0.0; employment -40.0

#### **Decline of Personal Computer Manufacturing in FRG Reported**

92WS0255B Duesseldorf WIRTSCHAFTSWOCHE  
in German 3 Jan 92 p 12

[Text] The dramatic collapse of the PC trade of Tuerkheim's Schneider Rundfunkwerke AG, which has led to the abandonment of independent production and development there, is casting a spotlight on problems

shared by the entire industry in Germany. Rising sales and profits in the PC trade are now being posted only by companies such as Vobis Microcomputer and Aquarius Systems, which sell complete standard components in the Far East at cut-rate prices.

The technical standard held up by Bernhard Schneider, major stockholder and now resigned head of the former music furniture company, with its high share of independent PC production in Allgaeu is scarcely honored on the PC market anymore. According to Diebold expert Fritz Jagoda, personal computers with an ever-greater performance level must be marketed today like mass articles on a nearly saturated market. He sees the current decline in PC prices as presenting generally "enormous problems" in terms of maintaining greater production depth in Germany.

This trend is also drawing into question the Augsburg production site of the last German PC producer with its own development department and electronics production, Siemens Nixdorf Informationssysteme AG (SNI). Although there is no talk of a complete abandonment of independent SNI PC development and manufacture, the board of directors, under the leadership of SNI chief Hans-Dieter Wiedig, is considering shifting significant parts of production to its own site in the Far East, possibly Indonesia.

#### **German Firm to Market Advanced RISC Computing System**

*92WS0260B Duesseldorf VDI NACHRICHTEN  
in German 27 Dec 91 p 22*

[Article by Egon Schmidt: "ACE Train Gains Speed: ARC System From Mips Basis of New Computer"; first two paragraphs are VDI NACHRICHTEN introduction]

[Text] Munich, 27 Dec (VDI-N)—RISC processors promise high performance at lower cost than before.

Tomorrow's top-of-the-line PC's will be based not only on Intel processors and their imitations, but also on RISC processors. At any rate, this goal is being pursued by the chip manufacturer Mips in conjunction with companies such as Microsoft, Compaq, SNI, DEC, and numerous other computer companies. They have all joined in the Advanced Computing Environment Initiative (ACE) and are sounding the attack against the bastions of IBM, Apple, and HP as well as RISC microcomputer champion Sun.

Systems of the Advanced Computing Environment Initiative based on RISC processors must, in the interest of general compatibility, correspond to a newly defined industry standard which ACE calls "Advanced RISC Computing" (ARC) and whose implementation should guarantee that in the future ARC computers will be as interchangeable as today's popular PC's. The chip developer Mips has now developed the first ARC system

based on the company's own 64-bit RISC processor R4000 as well as additional Asic-chips produced by NEC and Toshiba.

Companies—such as Olivetti or Acer, for example—that want to produce computers based on ARC RISC will soon be able to use not only these complete Mips systems, but also subsystems or even individual chips and thus "save 12 to 15 months of development time," explained Mips Sales Manager Willi Haas recently in Munich.

Haas explained that the ACE group now includes more than 200 companies, which, with annual sales of approximately \$60 billion, represent approximately one-third of total worldwide DP sales of from \$150 to \$200 billion. Soon, more than 45,000 programs will be able to run on the ACE computers, including approximately 90 percent from the conventional PC realm.

In contrast to the competing, new—yet compatible with Intel chips—Sun operating system concept Solaris, ACE runs the same with two operating systems: In addition to Windows NT, there is also SCO-Unix, stresses Haas. Solaris also offers, despite its support of Intel processors as well as the Sun Sparc processors, only about 3,600 application programs and, on top of everything else, only a few companies other than Sun would stand behind Solaris. In addition, in Sun processors data bytes are grouped differently than in Intel CISC and Mips RISC environments, which naturally would create additional compatibility problems.

Haas calculates that a special ARC computer system based on the Mips R4000 processor with a clock rate of 50 MHz "provides roughly two to three times the performance of an Intel system," but "costs \$600 less" to produce. Also compared to HP computers, ARC is more favorably priced, based on the same performance.

According to Haas, Mips is currently offering its comrades-in-arms in the ACE group a choice of individual processors, produced by at least six different manufacturers, plus Asic chip sets from three producers, and also finished platforms or even systems for OEM resale under their own name. Additionally, different levels of ARC licenses will be granted.

According to IDC, in 1990 approximately 24 million PC's as well as approximately 550,000 work stations were sold worldwide. And, according to Haas, at the end of October, so many companies were already members of ACE that "roughly 7 million PC sales" would go just to them; i.e., approximately one-fourth of the total 1991 market for PC's and workstations.

In this entire "desktop" market, in 1990 approximately 90 percent of the roughly 24.5 million had DOS operating systems along with Windows as well as Unix derivatives for Mips processors; however, only 8 percent were in the IBM/Apple sector as well as 2 percent in Sun/OS.

Haas anticipates that of the roughly 33 million 32-bit computers sold in 1995, as many as 6 to 7 million could already belong to the ARC class of machines. While approximately 22 million will be sold as n86 computers and 4 to 5 million would have other 32-bit processors. Also, according to IDC, an impressive 1.8 million RISC processors should be delivered as early as 1994, whereas in 1990 only approximately 200,000 were sold.

In this connection, it is also noteworthy that in response to specific questions, Haas admits: "Not all ACE members have obligated themselves to use Mips processors in their new RISC computers." Which applies, for example, to Digital Equipment.

#### Photo Caption

System platform of tomorrow's PC: Equipped with the Mips R4000 processor, SCO-Unix operating system software will run on this computer in addition to Microsoft Windows NT.

### Defense R&D

#### France: Optronic Submarine Detection System Developed

92AN0062 Paris *ELECTRONIQUE INTERNATIONALE* HEBDO in French 11 Oct 91 pp 16-17

[Article by Serge Brosselin: "Broadband Communications Come to Submarines"]

[Excerpts] The French Army has recently tested an underwater laser communications and imaging system that makes it possible to communicate with submarines at depths probably much greater than 100 meters and to visualize submarines from the sky. It is a world first.

Last June and July, the French Ministry of Defense conducted a series of experiments on air-underwater laser beam communications links in the Mediterranean. This program, known until now only to the military officials concerned, the details of which *ELECTRONIQUE INTERNATIONALE* HEBDO is today able to disclose, is one of the last stages of an ambitious research program being conducted under the aegis of the Directorate for Technical Research and Studies (DRET) of the General Arms Delegation (DGA). The project was intended to verify the feasibility of a future integrated optronic underwater transmission and detection system. [passage omitted]

#### Open Sea

Current research is directed toward "environment change" laser transmission allowing underwater laser transmission and imaging for detection purposes, operating on a 500-nanometer seawater transparency window.

The first technique consists of freeing the submarine from the constraints of the very low frequency (VLF)

wavelength by utilizing the laser beam's capability of penetrating to a few dozen meters beneath the surface.

Antenna deployment is then no longer required for the submarine and its vulnerability is thereby diminished to that extent.

The laser's passband is no comparison with the extremely limited VLF passband; its data transfer capability could attain the Gbits/sec level, if required.

To that should be added the laser's very high electromagnetic secrecy, which means that the transmissions can be listened to or jammed only if this is done in the beam path.

The second area of research, underwater imaging, harks back to the eternal rivalry between the weapon and the shield. At the current time, there is no means—even with the latest sonar developments—allowing reliable detection of an immobile submerged submarine.

That is just what is expected of the experimental mock-ups of the environment-change blue-green lidar developed by Thomson Sintra's submarine activities department and BMI (a small company with high level capability in the laser field) under a DGA contract (in cooperation with Canada, which is responsible for the study on the physical parameters of water).

According to DRET engineers, current research is grouped into two categories:

- Work dealing with the propagation of a laser beam emitted by an aircraft- or helicopter-borne device (and perhaps later by a satellite) to the surface of the water. According to statements made, there is full understanding of the link between the energy change of the signal and the causative element (during the passage of a cloud system, for example, the diffusion phenomenon predominates the absorption phenomenon, whereas refraction remains negligible).
- The second segment of the studies is still in the exploratory stage, although the initial work on such laser applications goes back to 1987. It is a question of establishing a signal/energy relationship (signal/noise ratio) when the signal is propagated vertically beneath the water (experiments have already been conducted on horizontal underwater propagation) so that the transmission can be carried out at an acceptable signal/noise ratio. The aim of the program undertaken last June and July was to determine what must be done to improve the conditions of laser beam propagation in an underwater environment.

The test equipment used to conduct this experiment consisted of two laser sources emitting above the water surface and a "pocket" submarine. The two laser sources were independent—one being a frequency-tunable titanium sapphire laser, the other, a YAG [yttrium aluminum garnet] laser of a different frequency. The choice of the two distinct sources is explained by the fact that

the experiment was also intended to determine the influence of the wavelength on the transmission of the signal under water.

### Major Role of Cesium Vapor

The originality of the system lies in the adoption, during emission, of an optical device that transforms at the exit of the source the highly directional narrow-beam laser into a broader beam with an average aperture (approximately 30 degrees).

The pocket submarine was equipped with a cesium vapor resonance transfer filter of a type already tested about two and a half years ago at the French Research Institute for Exploitation of the Sea (IFREMER), with a detector positioned immediately behind it, and a receiver (to which were added recording and support equipment). The role assigned to the filter was to shift the laser signal wavelength (between 350 and 500 nanometers) to 850 nanometers—an unavoidable operation to improve the signal/noise ratio, since the photorepeaters and the silicon receivers employed work best at 850 nanometers.

Since the signal/noise ratio was extremely weak because of the backscattering of the light and of static in an ocean environment, good reception of the signal required an extremely narrow passband filter, which rejects all "pollution" in which the signal was "drowned"—whence the use of the cesium vapor.

The other advantage of this filter compared to conventional optical filters is its insensitiveness to the orientational direction of the signal, thus constituting an advantage in an ocean environment in the event of strong surface movement, when diffraction of beam propagation can occur.

According to DRET officials, the major problem encountered was the complexity of the modeling of the deterioration of the energy balance, which is a function of several variables: the turbidity of the water, a law of exponential decrease as a function of the penetration depth of the beam into the sea, and a weakening of the signal due to the divergence of the same beam, which occurs at the time of each change of state in the environment traversed (cloud, atmosphere-water surface separation diopter).

This modeling seems to have been validated by the latest experiments.

### Underwater Imaging Becomes Reality

There is, however, another application which arouses enthusiasm as discretely admitted as it is intently "protected"—underwater imaging. That is the second aspect of this research program.

The experiment conducted in the Mediterranean covered only underwater communications. Underwater lidar imaging is based on a different principle: bathymetry. This technique consists of emitting two successive

pulses—one in the infrared, which is reflected on the surface of the water and detects it, the other, a blue-green laser, which traverses the same surface and photographs the ocean bottom and the tactical situation in the deep.

Of course, it would be illusory to imagine that one day it will be possible to employ this technique to examine the abysses of the San Andreas Fault; however, it would not be unreasonable to anticipate that, in the short term, imaging of the ocean bottom to a depth of at least 100 meters will be possible. The applications of the future systems are, we feel, numerous. They extend from simple mine detection to monitoring submarines and would include the detection of submarine minisubmersibles and navy frogmen.

When can industrial exploitation of the first optronic communications and underwater detection equipment be expected? "It is still too early to say, but there is a good chance that such equipment will see the light of day and operate very well," we were told by Jean-Paul Christy, head of the DRET "optronic optics" group, and Claire Valentin, low-energy laser specialist, who supervised the experiments on behalf of the Ministry of Defense.

[Box, p 17]

### Pulse Train Link?

The armed forces refuse—and their reluctance is understandable in view of the strategic stakes—to disclose any results of their experiments. It is easy to imagine, however, that the most effective method to pierce the obstacles with the blue-green beam is to maximize its density, which normally means a prior accurate pinpointing of the submarine by the transmitting aircraft. Since this must not be an obligation, it is probable that the armed forces are operating by scan with a spot surface of a few square meters and that they repeat, at high speed, the message to be transmitted during a scan so that the submarine is "struck" by at least one pulse train.

### EC: Merger of Defense Satellite Systems Considered

92AN0094 Paris *ELECTRONIQUE INTERNATIONALE* HEBDO in French 14 Nov 91 p 16

[Article signed Ph.L.C.: "Satellite Communications: Toward European Cooperation?"]

[Text] For the first time, six European countries have examined a possible merger of their requirements in military transmissions by satellite.

"Without satellites the French army is blind." For several months, Pierre Joxe, minister of defense, has not missed a single opportunity to drive home his point. He did it again last week while opening a colloquium called Eumilsatcom (European Military Satellites of Communication) in Paris.

Organized jointly by France and the UK, this colloquium brought together, for the first time, military and industrial representatives from six European countries on the subject of military telecommunications by satellite.

"There is the beginning of a major thought process on the effort to be undertaken to increase the range of observations, improve telecommunications tools, and, in the long run, merge all that into a single system," explained Michel Javelot, director of electronics and computer science at the General Armament Delegation (DGA).

However, with the Syracuse 1 and 2 programs, France is not deprived in the field of military telecommunications. Syracuse 1 has been operational since 1984 and is about to give way to Syracuse 2; between the end of 1991 and mid-1994, the French army will thus move from a network of 26 transmission stations (ground- or sea-based) to a network of 100 stations. "Until the year 2000 or 2005, French defense will have a fully operational system," underlines Michel Javelot.

But beyond? "For Syracuse 1 and Syracuse 2, cooperation between the Ministries of Defense and Post and Telecommunications made it possible to diminish the amount of investments," is the explanation given at the DGA. "For the successor of Syracuse 2, renewed cooperation, either with France Telecom, or in a new, more global approach, with other European countries, has to be considered."

Pierre Joxe pronounced himself in favor of this latter approach while emphasizing the necessity for defining "a common operational need" for several countries in Europe and then for implementing a system with "one or several European partners."

#### **France, UK Propose European Military Communications Satellite**

92WS0140C Paris LE MONDE in French 12 Nov 91  
p 10

[Unattributed article: "French and British Proposal; Six European Countries Consider Launching a Military Communications Satellite System"]

[Text] France and Great Britain have proposed to four other European countries—Germany, Italy, the Netherlands, and Spain—to start studying a military communications satellite network for the beginning of the next century. This new community system, to be developed bilaterally or by the WEU, was named European Military Satellite of Communications (EUMILSATCOM).

The project was put forward by France on Wednesday 6 November, at a symposium held in Paris at French and British initiative and attended by delegates of the six European countries involved. France, Spain and Italy are already working together to design the Helios military reconnaissance satellite system that will be ready by

the end of 1994. For the time being, France (since 1984 with the Syracuse network) and Great Britain (with the Skynet network) are the only two European countries to have their own military communications satellite systems. But these two networks do not communicate with each other and do not provide worldwide coverage, which would require at least three geostationary satellites operating simultaneously.

Based on an analysis of the future needs of the systems proper, of the hardware or transmission codes, and of the subscribers, the EUMILSATCOM program would aim to provide Europeans with a joint management of their telecommunications by 2005 and to lower their costs.

Speaking to his European partners, Mr. Pierre Joxe, the French defense minister, pleaded for a European space program. Referring to the Ariane launcher and the Helios program (with the prospect of a WEU center to interpret the images collected by the military observation satellite), he estimated that "the joint implementation and operation of satellite systems would represent a significant breakthrough in building a European defense system."

Mr Joxe did not for all that rule out the possibility of cooperation with the Soviet Union. After recalling that two colleagues of Marshall Yevgeniy Shaposhnikov, the Soviet defense minister, were invited to attend, on 3 December, the Ariane launching of the Telecom 2A satellite carrying a Syracuse military communications payload, the French minister announced that the General Delegation to Armament (DGA) would soon send a mission to the USSR, to explore "conceivable cooperation themes."

#### **Sextant Avionique to Develop Mermoz Test System for Rafale**

92WS0269F Paris LA LETTRE HEBDOMADAIRE  
DU GIFAS in English No 1543-2, 5 Dec 91 p 2

[Article: "Sextant Avionique: The Mermoz System for the 'Rafale'"]

[Text] Delegation Generale pour l'Armement (DCAe/STTE) confirms that Dassault Aviation has selected Sextant Avionique to design, develop and build the Mermoz test system for its Rafale. The order is estimated at over 1.5 billion francs for Sextant Avionique and involves at least 55 test systems, all versions taken together. Deliveries will start in June 1996 for the French Navy and Air Force and will continue until beyond the year 2000. The Mermoz system belongs to the global aircraft maintenance philosophy of Dassault Aviation. It will complete the aircraft's in-flight fault diagnosis possibilities. The project has four basic goals:

- to provide the Navy and Air Force with full maintenance facilities right from initial deliveries of the production aircraft;
- to facilitate operation and utilization;

- to aid in integrated logistical support;
- to improve cost control.

The Mermoz will be employed when receiving new equipment in the plant, and for the maintenance and checking of electric, electronic and optronic equipment. Test stations may be set up as fixed infrastructure, in the form of portable shelters or on aircraft carriers. Sextant Avionique will participate in the development phase and lend support during the operational phase. Sextant Avionique has established four partnerships with leaders in their fields:

- Aerospatiale, Tactical Missiles Division, consulted for physical and logistic conception aspects;
- SAGEM for optronics;
- COMSIP, an engineering division of CEGELEC and SOPRANO, a subsidiary of CEGELEC for integration and the supply of shelters;
- SERAe for air conditioning.

Sextant Avionique has acquired most industrial experience, notably with maintenance systems for the French Army (Diademe and second generation Diademe) and is therefore in a position to propose reliable and innovative solutions. These involve ATLAS 716 language, VXI Instrumentation, optronic test facilities, GO-NOGO test facilities in which cards filter out incriminated batches, special specifications and tools and program coding, monitoring of technical data and documentation.

### Energy, Environment

#### Operation of Flemish Environment Holding Outlined

92AN0049 *Zellik INDUSTRIE in Dutch Nov 91*  
pp 68, 71

[Article by Wim Heirbaut: "Collection and Recycling: VLAR Enters Market of Household Waste"]

[Text] The new subsidiary of the Flemish Environment Holding is called VLAR [Flemish Waste and Recovery Company]. VLAR was formed in order to deal with the collection, recycling, and processing of solid household and similar waste. Aquafin (water purification) and Indaver (toxic industrial waste) now have a new companion.

In Flanders, the waste processing industry is organizing itself. At the urging of the Flemish Regional Minister Kelchtermans, the Regional Investment Company for Flanders [GIMV] formed the Flemish Environment Holding [VMH] in 1990. VMH's task is to develop economic activities, whether on its own behalf or with the participation of third parties, which can contribute to improving the environment in Flanders. One of the first subsidiaries of VMH was Aquafin, which assumed responsibility for waste water purification. Also last year,

it was decided to incorporate the already existing Indaver in VMH (legally speaking, the transfer of SCK [Study Center for Nuclear Energy] and OVAM [Public Flemish Waste Company] shares has not yet been completed). Indaver treats toxic industrial waste. In the fall of 1991, the most recent VMH subsidiary was formed: VLAR.

VLAR will deal with collecting, recycling, and processing solid household and similar waste. Dirk Boogmans, GIMV manager and VLAR director: "One of the main differences between VLAR and Aquafin is that Aquafin is operating within the framework of an agreement with the Flemish Community; Aquafin was given the responsibility for the overall water purification policy. For household waste, however, such a structure was not possible. VLAR will not hold a monopoly position because the municipalities are already dealing with household waste processing. Therefore, VLAR will have to operate in a situation in which the municipalities are free to choose their partners." VLAR is granted a limited starting capital of 25.5 million Belgian francs. In the long run, this capital should grow to several billion francs. As is the case with Aquafin, VMH will keep a majority share of 51 percent. VMH will pay up its part of the VLAR capital with drawing rights on the Mina Fund. For the remaining 49 percent, GIMV is looking for four private partners. Dirk Boogmans: "On the one hand, negotiations are being conducted with industrial experts in the field of household waste, more specifically with a number of big companies from Europe and North America. On the other hand, there are talks with the Gemeentekrediet [Municipalities Credit Bank], because of the essential role of the municipalities in the field of household and similar waste."

Finally, we are also negotiating with Electrabel. According to Dirk Boogmans, these negotiations with Electrabel go beyond the incineration of household waste: "Incineration is no top priority for VLAR; on the contrary, it is the next to last step in the waste chain. Electrabel and its parent organization have shown a great deal of interest in environmental diversification in general. They would like to offer services in the form of a package."

Dirk Boogmans is expecting a strong commitment on behalf of the industrial partners: "They commit themselves within a concept. It is agreed that no one must enter into competition with VLAR. This is the reason why selection is rather important. GIMV wants to make sure that it selects the right partner, who should be capable of making a useful contribution: market knowledge, technology, general management. This partner must also understand the strategy of the environment holding in order to avoid disillusion. The freedom of action of such a partner is rather limited."

VLAR will become a subholding, with subsidiaries for the different, geographically spread projects, in particular (separate) collection and recycling. Depending on the project, VLAR can take a minority or a majority

interest. "In common agreement with our industrial partners, we have to detect a number of projects," says Dirk Boogmans. "We are also going to set up agreements with OVAM [Public Flemish Waste Company], because VLAR can also play a part in prevention policy."

### Profitability

Boogmans cannot tell just how fast these projects will materialize. Unlike water purification, there is no investment plan for household waste for the next five years. At this moment, OVAM is starting with a number of recycling projects, which show little profitability in the short and medium term. Does this not scare the industrial partners? Says Dirk Boogmans: "Since VLAR is a corporation, we have to provide remuneration for their own resources. So, the industrial partners must be assigned a mixture of projects: on the one hand, projects which have a high degree of profitability, and, on the other hand, projects which will take some time before becoming profitable. We do not want to abuse VLAR in order to maximize profitability. Aquafin and Indaver have also made similar agreements with their partners."

The price-setting process on the recycling market poses particular problems. In the past, the price of paper plunged when people started collecting old paper on a massive scale. A second (as yet unsolved) problem is the separate collection itself. If the consumer does not separate his waste products himself, it will become an expensive business for the collection and recycling company. Waste dumping and incineration are the last type of projects that VLAR is contemplating. Dirk Boogmans denies that the waste incineration installation for Flemish Brabant would be a priority project. However, nothing keeps VLAR from improving existing incineration installations in cooperation with intermunicipal companies.

Indaver will deal with VMH's activities in the field of toxic industrial waste. "It is not simple to organize these activities within a VLAR-like subholding, which is concerned with all types of industrial waste," says Dirk Boogmans. "Indaver's private shareholders are not eager to embark on such activities. However, there are a few ideas to realize projects which are in line with Indaver's actual treatment activities. Within VMH, we have already approved several measures with regard to industrial waste, which fall outside Indaver's scope; they will involve direct participation on behalf of VMH, especially in the field of oil waste and industrial dump sites."

The VMH already has a 3 percent interest in Deme, the new holding of the dredging companies Dredging International and Declodt. VMH is also discussing an interest in two tank cleaning companies in Ghent and Zeebrugge. Finally, VMH decided to participate in a company involved in industrial soil improvement.

### Belgium Fails to Implement EC Regulations

92AN0051 *Zellik INDUSTRIE in French Nov 91*  
pp 62-63, 65

[Article by A. M. Eckstein: "Green Belgium: Not For a Long Time Yet"]

[Text] The European Commission has just published a highly critical report on Belgium's lack of respect for EC environmental regulations.

Whether in the area of water quality, waste management, industrial atmospheric pollution, or the protection of nature reserves, Belgium holds the sad record of being one of the European Community's worst offenders. The reason for this is that the implementation of European directives has often been either delayed or not even incorporated into national legislation. This situation is endorsed by the institutional confusion reigning in the country.

A report by the European Commission on the member states' respect for their obligations in terms of turning Community directives and regulations into national legislation names the good and offending parties. Although the U.K. usually balks when a new piece of Community legislation is adopted, once this has been "passed" it regularly translates its terms into national law. The same nearly faultless record applies to Denmark. Belgium, however, is one of the most undisciplined of the Twelve. An annex to the report, dealing specifically with the environmental sector, emphasizes this national "character trait."

### Regionalization + Environment = Confusion

The Commission says that when legislation is adopted in Belgium to make a Community directive into national law, it is generally compliant. But, the European experts stress, political and institutional changes as well as the difficulties of sharing responsibility between the resulting different levels of power often cause serious violations. This is particularly true for environmental issues. Belgium's regionalization process is seriously undermined: There are contradicting policies between north and south and policies are often nonexistent for the Brussels region. If, in certain cases, we add respect for national rules, Belgium is like a true environmental patchwork.

Not only do regional and national authorities not have the same policy or policies, but coordination and communication between them leaves a lot to be desired. The European Commission therefore recognizes that, although certain measures have indeed been taken at regional level—the Walloon and Flemish Regions are practically up-to-date on at least four directives—they have in general not been notified, despite two rulings by the European Court of Justice. The national government has not even communicated these directives to them. The Court is constantly rapping the Belgian Government on the knuckles: In 1990 alone, the Court reached six

reasoned opinions and opened two cases..., procedures which both the regional authorities and the national government (the only "official" mediator for the EC) seem to take little notice of.

### Belgium Is Too Polluted

The Commission report highlights Belgium's inadequacies in great detail. The Brussels region still does not comply with the terms of the directives on waste, used oils, PCB-PCT's, and titanium dioxide (all of which date from 1975, 1976, and 1978). As for noise, measures involving the implementation of directives on lawn mowers, hydraulic shovels, and cable-activated excavators have not yet been communicated, whereas in the case of water nothing has been done by the Walloon region to transpose neither the 1980 directive on the quality of ground water (despite a ruling by the European Court of Justice) nor the 1988 directive on the dumping of certain dangerous substances.

Belgium has not provided any report on the application of directives on waste. And there are good reasons for this. There are no plans to date for the elimination of either traditional, toxic, or dangerous waste either for the Brussels or the Walloon regions, the European experts pointed out. As for the so-called "Seveso" directive, its application is "more than dubious," according to the EC report which underlines its shortcomings: nonexistent or insufficient emergency plans associated with a lack of control and coordination by the authorities.

Belgian legislation on drinking water does not comply, either. Although the Flemish and Brussels regions are now in order, the Walloon region is turning a deaf ear to this, despite the European Court of Justice call to order. However, in the case of Flanders, although Community law has been implemented, this is because of an explicit exemption specifying that the level of authorized concentrations for two pesticides can be exceeded.... Again on the subject of water, the Commission points to the lack of information provided by the Belgian Government on this subject, which is incompatible with its Community obligations, despite the availability of scientific reports which refer to the bad quality of surface and ground waters and the absence of sufficient purification measures: Rivers and streams are nearly all polluted and bathing waters are of bad quality.

Polluting industrial waste and the contamination of drinking water by nitrates and lead are, according to the EC, commonplace in Belgium.

The 1984 directive on atmospheric pollution by industrial plants is not very popular in Belgium either. This is, in fact, badly implemented by the legislation organizing the administration of authorized installations. The Commission particularly underlines the absence in general of any national or regional legislation on this issue, the absence of any obligation to take the directive's criteria into consideration when authorizations for industrial development are issued, the absence of references to the

best available technologies, and, finally, the lack of obligation for the provision of the gradual adaptation of existing plants.

As for environmental protection in general, Belgium is still at the "good intentions" stage: Although certain zones have been classified as "special protection zones for the conservation of wild birds," real protection for these reserves is still largely insufficient, the Commission notes, highlighting "persistent problems" in the areas of hunting and especially netting.

### The Solution

No excuse or consolation is offered. However, the Commission does admit that Belgium is not alone in its unwillingness to apply Community regulations for the protection of the environment. The Commission recognizes that instances of noncompliance of national law with Community texts are still too numerous and incorporation into national legislation within the required deadlines is rare among the 12 member states. Moreover, the application of these texts is most often entrusted to various government departments which rarely show any willingness to comply with them. The Commission also emphasizes the difficulties that it encounters in obtaining full, reliable, and regular information both on the application of Community directives and on the state of the environment. At this stage, the Commission can only remind member states of their commitments and obligations and hope that the setting up of a European Environment Agency—which has now been decided on, but which is blocked because of the row over the siting of the headquarters of the European institutions—will help solve these problems. One of the functions of the agency will be to keep a closer watch on the state of the environment. Another will be to collect, process, and distribute objective and reliable information on the state of the environment.

Another establishment: Since the environment belongs to everybody and nobody and Community efforts to ensure that EC law is respected are usually triggered by individual complaints, the respect of Community law depends on interest in environmental protection and on the motivation of people complaining, which often varies according to the degree of alarm at the local level. This is one reason for the unequal geographical distribution of the number of complaints which in turn results in the risk of a geographically unbalanced application of Community law. To settle these problems, the Commission is considering, on the one hand, to introduce a system of environmental complaints at the level of member states, thus obliging them to seek a satisfactory solution, and, on the other hand, to grant environmental protection organizations or individuals the right to litigate on environmental matters.

### EC Eco-Audit System Explained

92AN0052 Zellik INDUSTRIE in French Nov 91 p 67

[Excerpt] [passage omitted]

**[Box]****Brief 'Green' Glossary**

It is difficult to implement the famous European directive on so-called "green audits." The initial proposal prepared by Michel Chaugny from the European Commission's Directorate General (DG) XI [responsible for Environment, Consumer Protection, and Nuclear Safety] was watered down due to pressure from major European companies including CEFIC [European Council of Federations of the Chemical Industry]. Instead of being compulsory, it is likely that environmental audits will be voluntary. However, it is possible that in four to five years time, the Commission will have the power to oblige certain companies to undergo eco-audits.

Environmental audits, as defined by the Commission, will comprise the systematic verification of the effects of a company's activities on its environment. They represent far more than a simple impact study and will comprise real company management of environmental issues. Verifications carried out by these auditors should include emissions into the atmosphere, water, and ground, and their impact on neighboring communities, the landscape, and public opinion.

According to the consultancy company DRT Europe Services, sectors to be directly affected are chemical industries (accounting for the strong reaction by CEFIC), the pharmaceutical, plastics, cement, and glassmaking industries, manufacturers of detergents and synthetic fibers, shipbuilders, airplane manufacturers, paper manufacturers, agriculture, fish and other food processing industries, manufacturers of leatherwear, the wool industry, the production of computer equipment, as well as oil refineries, electricity suppliers, and waste processing industries. Other industries could be added to the list in future.

Companies that undergo these eco-audits will be allowed to advertise this through sporting a symbol (a kind of eco-label) on their products. The findings of these audits—a delicate issue—may be made public and transmitted to the appropriate authorities.

Because of the experience acquired in the U.S. market, the Arthur D. Little consultancy was commissioned by the EC to draw up the guidelines for a second draft European proposal which will be submitted to the European Commission Executive.

"These audits are a valid management tool and aim to evaluate in a systematic, periodic, and objective manner the effectiveness of a company in environmental affairs," Philippa Knapp from AD Little explained. "These are truly instant photos of the environment," Thierry Paquot, also a consultant at AD Little Brussels, continued. In other respects, the British PNA Bureau was charged with the fieldwork for testing the different methodologies for environmental audits. About a dozen specific cases will be examined.

The final stage of this generally complex obstacle course remains: the implementation of a real European directive. This is scheduled for next year.

Another subject which is also topical concerns the problem of environmental stock-taking. These are genuine forms of chartered accountancy in environmental affairs.

This kind of stock-taking bureau does not yet exist in Belgium. In France, however, a former mining engineer created a company called Ecobilan which already has a sales revenue of over 60 million Belgian francs.

The Life Cycle Analysis Society (LICAS), an international organization bringing together environmental experts, is also in the process of being created. "We are setting up in the Netherlands a foundation which will be sponsored by major companies and which will analyze the whole life cycle of different products. To ensure its credibility, we would like this foundation to operate in the form of a neutral organization. Sponsors will have no part in the delineation of the methodologies used, nor the choice of experts," according to Mark Dubrulle, consultant at Dubrulle-van Schaardenburg and Partners. Also the European Environment Agency, currently blocked by a French veto, is still in the process of being set up.

**EC's SAVE Energy Efficiency Program Approved**

92AN0066 Antwerp DE FINANCIEEL-  
EKONOMISCHE TIJD in Dutch 30 Oct 91 p 5

[Article signed K.V.I.: "European Energy Policy Plays It Safe"]

[Text] Luxembourg—Yesterday, EC energy ministers gave their final approval to the SAVE program for efficient energy consumption. They were less enthused by the combined tax on energy consumption and CO<sub>2</sub> emissions than their counterparts of environmental affairs. The Twelve also approved a procedure which is to be implemented if a crisis situation occurs on the oil markets.

The SAVE program is aimed at reducing energy consumption in the EC and its member states by 20 percent in five years time. ECU35 million has been provided to finance a minimum of 30 percent of the specific actions. Initiatives taken by member states to improve their infrastructure in terms of energy efficiency will be supported. In practice, SAVE will operate as a framework for the enforcement of several strictly technical measures, such as minimum efficiency requirements or obligatory periodical inspections. SAVE will also try to modify the behavior of European consumers, for example by imposing manufacturers to indicate the real energy consumption on the labels of household appliances or by charging heating costs in buildings on a pay-as-you-consume basis.

The Twelve have already approved a directive on this issue which harmonizes legislation in the member states concerning efficiency requirements of new heating boilers. Henceforth, oil and gas-fired heating boilers in the 10- to 400-kW range which meet the requirements may be sold throughout the EC.

#### Energy Tax

EC energy ministers also held initial discussions on the Commission's proposal for a European energy tax. The tax would add \$3 to the price of a barrel of oil in 1993. The price of oil would increase by a further \$10 per barrel by the year 2000. In addition, the tax would be higher for energy sources with high CO<sub>2</sub> emission levels. The EC environment ministers had already decided in favor of such an environmental tax.

At yesterday's meeting, several delegations asked for supportive measures for industry sectors that consume a lot of energy. Furthermore, several EC ministers for energy insisted that the United States, Japan, and other close competitors be urged to take similar measures. In December, a joint meeting of the ministers of the environment and energy will adopt a definite standpoint on the issue.

Moreover, the Belgian Minister of Economic Affairs Claes raised the point that it is inconsistent to urge the OPEC countries to lower oil prices while the EC actually raises consumer prices. Claes also requested that a formula be worked out to protect the socially deprived or to compensate them for high energy costs.

#### Crisis Procedure

Yesterday, the Twelve also approved a memorandum of understanding on the measures which have to be taken in the event of an oil crisis. The situation on the oil markets is to be evaluated within the International Energy Agency (IEA). The EC member states will adhere to the EC's common position at the IEA meetings. The EC Commission will be authorized to coordinate possible measures of the member states. It now has to present a mandate to negotiate with the IEA about individual membership.

#### Netherlands: CO<sub>2</sub> Storage in Empty Gas Fields Studied

92AN0088 Rijswijk POLYTECHNISCH WEEKBLAD  
in Dutch 7 Nov 91 p 1

[Article by Bart Stam: "Storage of Carbon Dioxide in Gas Fields Very Promising"]

[Text] The storage of carbon dioxide in exhausted natural gas fields is an interesting alternative in the battle against the greenhouse effect, argues K. Blok, who will obtain his doctor's degree at the State University of Utrecht on 11 November. His thesis "On the Reduction of Carbon Dioxide Emissions" deals with the removal of carbon dioxide and various forms of energy saving.

With the support of the Natural Sciences and Society Research Group of the State University of Utrecht, Blok developed a process which allows the separation and eventually storage of carbon dioxide (CO<sub>2</sub>) after the gasification of coal. He suggests storing CO<sub>2</sub> in "empty" gas fields through pipelines. The process produces a gas which is rich in hydrogen and has a purity of 87.5 percent. According to Blok, this gas is perfectly suitable, after treatment, for the production of electricity, for fuel cells or—although that is still in the future—for car fuels. On paper, the prospects for Blok's method look very bright. In his dissertation, he indicates that as much as 5.7 billion [metric] tons of carbon dioxide a year can be stored in exhausted gas fields worldwide. "This would be enough to store all CO<sub>2</sub> emissions from coal heating for a period of 40 to 50 years," says the doctoral student. Coal is the most suitable of all fossil fuels. "By nature, it is a polluting fuel, which is transformed into a clean fuel. For natural gas, the whole process is assumed to be three to four times as expensive."

#### Chemical Reaction

During the gasification of coal, a gaseous product is formed which consists of 93.9 percent carbon monoxide (63.5 percent) and hydrogen. With steam as a catalyst, a chemical reaction brings about the transformation into a mixture of mainly (92.8 percent) CO<sub>2</sub> and hydrogen (H<sub>2</sub>). The celexol liquid binds the CO<sub>2</sub> and then a high-pressure expansion process causes the CO<sub>2</sub> and the hydrogen-rich gas to be separated. Once the carbon dioxide has been separated, pipelines convey it to the available reservoirs. In the Netherlands, these are located some 3 km underneath the surface level. Because CO<sub>2</sub> has a higher density than natural gas, the storage capacity of carbon dioxide is higher, says Blok. As a result, it will probably be possible to extract more natural gas if CO<sub>2</sub> is injected into a field which is half empty. The heavier carbon dioxide will, as it were, "push" the natural gas out.

#### Higher Costs

In his thesis, Blok calculated that a KV-Steg unit combined with CO<sub>2</sub> removal has an efficiency of 38 percent. A "normal" KV-Steg unit, in which coal gasification and power production are integrated, reaches an efficiency of about 44 percent. If the process is used for producing electricity, the production costs are increased by approximately one-third. But the great advantage is that considerably less carbon dioxide is released into the atmosphere. An installation with separation of CO<sub>2</sub> produces only 14 to 15 percent of carbon dioxide emissions per kilowatt-hour in comparison to a "normal" KV-Steg unit.

#### Demonstration Project

In his thesis, Blok advocates a Dutch demonstration project for coal gasification with CO<sub>2</sub> storage: "By the year 2000, several smaller natural gas fields will become available in the Netherlands. These fields could then be

used for such a pilot project." In the intervening years, scientists could, for instance, do research on the geological situation and on the risks of overpressure and leakage.

The Ministry for Housing, Physical Planning, and Environment is interested in Blok's research. The Ministry sees the storage as an additional possibility to limit the emissions of carbon dioxide, in addition to saving energy. The Ministry intends to include the results in the so-called "Global Research Package on CO<sub>2</sub> removal."

### Dutch Industry, State Environment Spending Compared

92AN0092 *Rijswijk POLYTECHNISCH WEEKBLAD* in Dutch 14 Nov 91 p 7

[Article: "Government Spends More Money on Environment Than Industry"]

[Text] During the last three years, governmental and semi-governmental institutions spent about five times as much money on environmental measures than did industry. This was revealed by a survey conducted by Research and Marketing from Heerlen.

The survey "Environmental Outlines" was conducted in order to establish the extent and composition of the environmental market. It showed that in the Netherlands this market includes over 50,000 companies, (semi)governmental institutions as well as engineering bureaus and consulting agencies, which together employ some 83,000 people. As far as the companies are concerned, they are mainly involved in industrial activities, contracting, wholesale business, and professional transportation.

A striking fact revealed by the survey is that governmental and semigovernmental institutions invested much more money in environmental measures than did industry. Governmental and semi-governmental institutions (Department of Public Works, district water boards, purification boards, and public service corporations) spent an average of 1.5 million guilders a year on environmental measures, whereas industry spent only 300,000 guilders. In addition, it was revealed that government bodies, companies, and engineering bureaus invest mostly in waste measures (41 percent), followed by measures regarding water, air, soil, and noise.

### More Money

Sixty-two percent of the companies, engineering bureaus, and government bodies that invested in environment over the last three years plan to spend more money on environmental measures during the period ending in 1994. On average, the increase will amount to approximately 40 percent. One-quarter of the investors are projecting the same level of investment. And of the companies and nonprofit institutions that did not invest during the last few years, 51 percent have plans to make

investments during the next three years. However, 36 percent still have no investment plans at all.

### European Car Manufacturers to Limit CO<sub>2</sub> Emission

92AN0129 *Antwerp DE FINANCIEEL-EKONOMISCHE TIJD* in Dutch 23 Nov 91 p 12

[Text] Brussels—The European Association of Car Manufacturers (ACEA) plans to reduce CO<sub>2</sub> emissions by 10 percent for cars which are to be sold between 1993 and 2005 by 10 percent.

With this voluntary restriction, car manufacturers are showing their support for the EC Commission's proposals to reduce emissions of CO<sub>2</sub> and other hazardous substances. Following a proposal by the EC Commission, the Twelve agreed a year ago to stabilize CO<sub>2</sub> emissions by the year 2000 at the 1990 level and to subsequently reduce them.

The 15 most important European car manufacturers are members of ACEA. Only the French company Peugeot has not joined ACEA.

European car manufacturers have already succeeded in reducing the energy consumption of their cars by more than 20 percent since 1978. They argue that measures should be taken in order to improve traffic control and that research should be carried out continuously for alternative energy sources. In addition, they would like to see specific driving habits encouraged which allow a more efficient use of the engine.

The voluntary restriction of CO<sub>2</sub> emissions is also part of a fully integrated European approach for the reduction of carbon-dioxide gases. In turn, this fits in with a balanced worldwide program which is to deal with the greenhouse effect. If an energy levy is part of that program, it should be compensated by alleviating the heavy burden that the consumer has to carry when purchasing or buying a car, says ACEA. "Measures which have no other purpose than to burden industry can be to the advantage of competitive industrial regions which are not willing to take such steps."

### France: Major Arctic Ozone Experiment Launched

92AN0135 *Paris SCIENCES ET AVENIR* in French Dec 91 p 10

[Excerpts] From 15 November 1991 through 31 March 1992, nearly 250 scientists from 17 countries are going to study the problem of the ozone layer in the atmosphere at the North Pole. The resources committed are unprecedented: 40 balloon releases, 10 aircraft-based experiments, several sounding rocket launches, and numerous ground-based activities in order to gain a better understanding of the processes destroying the ozone layer in the arctic regions. [passage omitted]

The European Arctic Stratospheric Ozone Experiment (EASOE) would provide, among other things, test results on their behavior [of fluorocarbon substitutes] in the critical zone, between 25 and 40 km of altitude. The campaign is being undertaken at a time when the international scientific community is increasingly being alarmed: four out of five years (1987, 1989, 1990, and 1991) have seen serious reductions in the ozone layer. The deficiency has risen, on the average, to approximately 10 percent in the temperate zones, 20 percent in the Arctic, and up to 40 percent in the Antarctic, where a total disappearance of ozone was detected in a layer located between 10 and 15 km of altitude. The very first results from EASOE are expected by mid-December.

### French Senate Approves Bill for Research on Radioactive Waste Management

92WS0161D Paris LE MONDE in French 08 Nov 91  
p 13

[Article: "Senators Vote to Leave Planet Clean"]

[Text] By a vote of 290 to 11 on Wednesday 6 November, the Senate passed the bill on radioactive waste management research, which the National Assembly had already passed by a wide majority last spring (see LE MONDE of 29 June).

Sounding very professorial, Mr. Dominique Strauss-Kahn, ministerial delegate for industry and external trade, said it over and over again: The purpose of the bill on elimination of radioactive waste is not to designate the handful of sites where such waste will be buried for some tens of thousands of years. But since ANDRA [National Agency for Radioactive Waste Management] has been engaged, under the successive governments of Jacques Chirac and Michel Rocard, in virtual trench warfare in those departments (Ain, Aisne, Deux-Sevres and Maine-et-Loire) that were selected as the leading candidates to become eventually the country's "nuclear dumping ground," Mr. Strauss-Kahn was probably wise to emphasize the point.

As the minister noted during a short senate recess, the government last spring had even deemed it useful during the National Assembly's consideration of the bill to call for help from [Ministers] Hubert Curien and Brice Lalonde, who are responsible respectively for research and environmental affairs, the better to alleviate the concerns of several Socialist deputies. Neither the parliamentarians nor the general public yet has a good understanding of why the Ministry of Industry, which manages the entire nuclear power production cycle, is also responsible for regulating the industry. The bill actually has only one purpose, that of launching a 15 year period of research on radioactive waste processing, at the conclusion of which Parliament is expected to revisit the problem.

This program, costing a total of 12 billion French francs [Fr], is supposed to cover the conversion, treatment and storage of radioactive waste in various geological strata

(salt, clay, granite or schist) deep below the surface. Until a moratorium was ordered by Mr. Rocard in February 1990, it was precisely these subterranean "laboratories" that frightened the communes concerned. Mr. Henri Revol (Republican and Independent, Cote-d'Or), rapporteur of the commission on economic affairs and planning, pointed out that "the nuclear age entered our lives with Nagasaki and Hiroshima," and since then nuclear power has been a constant source of "diffuse and irrational fears," whereas no one gets upset about the number of highway deaths (more than 9,000 victims per year nationwide).

### Germany: Fuel-Saving Automobile Ignition System Presented

92MI0174 Bonn WISSENSCHAFT WIRTSCHAFT  
POLITIK in German 27 Nov 91 pp 4-5

[Excerpts] How can dangerous pollutants be reduced during combustion, and how can the mechanisms that produce them be understood? Serious environmental problems and stricter legal regulations mean that private and industrial incineration plants and automobiles must use the most modern technologies. This was the explosive topic addressed recently by around 400 experts from research and industry at the conference on "Incineration and Combustion—15th German Flame Day" held at the Ruhr University, Bochum.

The conference was organized by Professor Hans Kremer (Power Plant Engineering, Faculty of Engineering at the Ruhr University, Bochum) for the German Combustion Research Association, the German Section of the Combustion Institute, and the Association of German Engineers Power Engineering Society (VDI-GET); participants from Germany and abroad heard over 60 papers on research results that have reached the application stage and were able to exchange a wide range of operating experience.

A highlight of the conference was the presentation of a new plasma-beam ignition system for Otto engines that reduces fuel consumption up to 10 percent. This technology was designed to use environment-friendly low-reaction fuel mixtures that tend to reduce engine efficiency as a result of delayed combustion. The new high-voltage design reduces electrical ignition power and, consequently, wear on the initiating electrodes.

Another improvement was obtained by raising the energy density and the efficiency of the plasma beam. Whereas surface discharge can occur with conventional spark plugs, causing loss of ignition power, the new plasma-beam ignition has contact-free air discharge. In addition to efficient thermal transfer of ignition power, with motor-induced combustion the point where the mixture ignited is of major importance. With conventional ignition "quench losses" occur at the electrodes, causing partial extinguishing of the flame's inner cone. The plasma beam makes it possible to create a stable inner cone in an unrestricted gas volume.

The experts want to use flame-free ignition systems to tackle the problem of nitrogen oxides, which have come under fire from environmentalists. This technology is based on the steady admixture of large quantities of exhaust gas to the combustion air. The regulating burner nozzle geometry then makes for controlled, low-pollutant combustion, without a visible flame.

### Germany: Siemens Develops Ultrasonic Aerosol Gas Substitute

92MI0175 Bonn DIE WELT in German 7 Dec 91 p 20

[Text] Finely nebulized liquids are of great importance, both in the home and in industry. Though spray cans are convenient to use, the ban on propellants containing chlorofluorocarbons has created difficulties. Siemens, which has been producing ultrasound-generating piezoceramics for a long time, has now developed an entire range of ultrasonic transmitters capable of nebulizing a variety of liquids into aerosols. Various design principles are used; for instance, a roughly thumb-sized nebulizing unit that works with an ultrasonic transmitter at 100 kilohertz, is used to construct handy, system-independent appliances. Liquids fed onto the transmitter nebulize into a fine spray with drops about 15 micrometers in size. The device, dubbed the "Liquisol," is currently being tested in various industrial firms, nebulizing liquids including organic solvents, alcohols, hairsprays, cleaning agents, and even ordinary water (for example, to humidify the air). Even fuels, diesel oil, gasoline, and methyl alcohol nebulize well, and can be used to run internal combustion engines or heating systems. The pharmaceutical company Boehringer Ingelheim has developed a pocket inhaler with an ultrasonic transmitter powered by two small batteries; the inhalants, for example drugs for treating asthma, are contained in a small replaceable ampule. The cosmetics firm Wella uses the ultrasonic transmitter to apply hairspray. Siemens, however, has developed yet another nebulizing system, which it calls "Liquifog," for air humidifiers. The underlying principle is that the piezoceramic is shaped to focus ultrasonic waves regularly on one point, where the water molecules are regularly "vaporized" by the intensive ultrasonic excitation. It is as yet uncertain whether the new nebulizing systems will be successful on the market: nebulizing systems whereby the air is hand-pumped to high pressure inside the container are more economical, in addition to which the Liquisol's 100-milliliter fluid capacity is relatively small. It does, however, produce a very fine spray. The use of ultrasonic nebulization to achieve greater fuel economy in internal combustion engines has previously been successfully demonstrated in experiments, though response from engine manufacturers is still restrained.

### France's CNRS, CNES Launch Ozone Layer Study

92WS0178C Paris AFP SCIENCES in French  
14 Nov 91 pp 44, 45

[Article: "European Study of Arctic Ozone Layer Launched"]

[Text] Paris—A scientific campaign to study the "holes" in the ozone layer over the Arctic, primarily by means of some 40 stratospheric balloons, will get under way very shortly.

Between 15 November and the end of March, 250 researchers from 17 countries will participate in EASOE (European Arctic Stratospheric Ozone Experiment), which was introduced on 7 November in Paris by the officials from CNRS (National Center for Scientific Research) and CNES (National Space Studies Center) who are in charge of the project. They will take measurements on the ground, overfly the zone in research aircraft, equip probe-rockets, and most importantly send immense transparent balloons into the stratosphere to collect crucial data.

It has been common knowledge for several years that there are [ozone] "holes" over the Antarctic. These are mainly believed to be caused by release into the atmosphere of chlorous gases (CFC's or freon, used in aerosol sprays, but more importantly in refrigeration and the manufacture of plastic foam). Since ozone holes offer no protection against ultraviolet rays, they are a global threat, both to man, with his fragile skin, and to the ecosystem, including life in the sea.

The ozone holes over the North Pole are not as well known, though several observation missions have already been carried out, the most recent of which, Cheops 3, took place two years ago. Those missions established that the phenomenon also occurred in the Arctic but on a smaller scale, in the form of localized "mini-holes."

"The balloons play an indispensable role in this campaign," says Michel Audebert, head of CNES's balloon division. Satellites are too far away to provide good data. And balloons are the only vehicles that can travel through the stratosphere without perturbing it.

Filled with hydrogen and carrying a 20 to 500 kg gondola, the balloons launched from Esrange station in Sweden will take two to three hours to reach their target altitude of 30-40 km above the earth, where they will stay for several hours depending on experimental requirements. Then a command will be sent by remote control from the ground ordering the gondola to detach and descend slowly to earth.

Balloons used to pose several problems, Mr. Audebert explains. First of all, the extreme temperature in the stratosphere, which can get as low as -85°C. So researchers have developed a special remarkably light polyethylene balloon-skin designed to withstand the extreme cold.

Another problem: gondola recovery. Winds blow toward the east at this time of year, and until quite recently the USSR refused to allow overflights of its territory or the recovery of gondolas on its territory. This drastically limited the time aloft for carrying out experiments. Thanks to "glasnost," an accord has been signed that will

allow the gondolas to go all the way to Siberia. As a result, experiments can last up to 10 hours.

This new research project may have almost immediate repercussions: The Montreal protocol of 16 September 1987, revised in London, which set targets for reduction of CFC emissions, comes up for renewal in June 1992, about the time results of the EASOE mission are due to appear.

### **Germany: ICL Data Pioneers Computer Scrap Recycling**

92MI0179 Wuerzburg UMWELTMAGAZIN  
in German No 11, Nov 91 pp 44, 46

[Article by Wolfgang Giselher Koelbach: "Recycling of Computer Scrap—Personal Computers Dismembered into Seven Sections"]

[Text] ICL Data GmbH, formerly Nokia Data, is part of the Nokia Group, which was founded in 1865, has its headquarters in Finland, and operates in 33 countries worldwide. The company's ergonomic products have for years been helping to improve working conditions, and it is now giving thought to environment-friendly computer recycling. In 1988 alone, around 1.5 million VDU's [visual display units] and terminals were installed in the older laender, and there was no form of disposal other than incineration.

### **New Approach to Disposal**

Working with Reichart Metals of Pulheim, near Cologne, the firm has developed a new disposal strategy, which was explained to the public at the opening attended by Federal Environment Minister Toepfer, of the new dismantling workshop at Pulheim in August this year.

Fifteen employees are currently dismantling around 50,000 VDU's, printers, and telephone equipment per year in the new workshop on a 7,000 m<sup>2</sup> site. The units are normally separated manually into seven sections:

- **Iron and metal scrap:** All metal parts of VDU's keyboards, control units, and printers are collected in containers. After sorting, iron, aluminum, copper, and zinc are melted down and reprocessed by steel mills and metalworks.
- **Technical plastics:** Technical plastics from VDU's and keyboards are cleaned and pulverized. The pulverized stock is used in plastics-processing factories to manufacture new products.
- **Printed circuit boards:** The semiconductor chips, capacitors, and resistors are mechanically removed from the printed circuit boards. These materials are collected in steel casks and used by a specialist firm in incineration and wet processes to recover heavy and precious metals. A state-registered sampler controls the entire recovery process on the spot.

The remaining plastic board, including the metal coating, is shredded by a specialist firm. The shredded material is sorted into metal and plastic. The metal is recycled, and the plastic is dumped with due concern for the environment.

- **Plugs and plug connections:** All plugs are dismantled and handed over to a specialist firm along with the semiconductor chips, capacitors, and resistors from stage 3 above, "printed circuit boards," for recovery of heavy and precious metals.
- **Cables:** All cables are shredded, after which copper and plastics are mechanically sorted and recycled. Uses for plastic from cables include hardcore foundations for roads and the manufacture of flowerpots.
- **Batteries:** All dry batteries from VDU's and printers are manually removed, collected, and dumped with due concern for the environment. Some batteries can be reconditioned.
- **Glass:** The vacuum in the picture tube is first dispersed to eliminate any danger of implosion. Copper and deflection coils are removed from all picture tubes, these are then mechanically broken up and other metals are removed. After sorting, the metal and steel scrap is melted down and reprocessed by steel mills and metalworks. At present, glass from VDU screens is not yet recycled: A process for which a patent is pending will soon solve this problem.
- **Close cooperation needed** as explained by Juergen Olschewski, managing director of ICL Data GmbH Germany, progress with environment-friendly design can only be achieved if industry, scientists, legislators, trade associations, and customers work together. This points to the need for colleges of technology and universities to establish departments with syllabi covering not only the production, but also the "decommissioning" of computers.

The lesson taught by manual dismantling of today's obsolete equipment must be learnt, and only 100 percent recyclable computers should be developed in the future.

### **[Box Insert]**

This is how Nokia System Recycling relieves the strain on the environment:

- **Terminal recycling**—this means that only 8 percent of the original volume has to be dumped; all other parts are reused.

**PC Recycling** 95 percent of all parts of a Nokia PC can be reused by steel mills, metalworks, and plastics manufacturers. Only one-twentieth of the original volume—about 5 percent—has to be dumped with due concern for the environment.

**Keyboard recycling** All materials from keyboards can be almost 100 percent reused.

## German Chemical Industry Steps Up Container Recycling

92MI0180 Wuerzburg UMWELTMAGAZIN  
in German No 11, Nov 91 p 48

[Text] Disposal of packaging has become a serious problem for industry, especially as the available disposal capacity is rapidly diminishing: The excessive burden placed on it indicates the drastic need for a new approach to disposal.

Not only do packaging materials used for chemicals frequently remain contaminated with traces of the product after emptying, thus requiring complex processing, but the vast range of chemical products rules out standardized treatment for packaging.

This problem has led the Chemical Industry Association (VCI) to present its "strategy for the recycling and disposal of packaging in industry and trade" (VIP-CI), whereby a disposal association operating at regional level would be set up by the chemical industry's customers and reconditioning, recycling, and disposal firms.

### Purpose of the Project

There are around 11 million chemical drums, in sizes ranging from 30 to 1,000 liters, in circulation in the Federal Republic of Germany (excluding the new laender). The number of containers with capacities below 30 liters is not known, but is estimated to be far higher.

In recognition of the increasing problems involved in special waste disposal, the chemical industry has set itself the following objectives:

- Use, as a basic principle, of recyclable packaging;
- Reduction in the range of packaging, and a trend towards larger units and standardized packaging;
- Development of technologies for cleaning and reprocessing used packaging.

The chemical industry considers that it would be impractical for it to take back used packaging itself, owing to the unacceptable cost this would involve. The VCI strategy therefore envisages the use of specialist disposal firms and carriers, the cost of disposal being reduced by the shorter hauls for the empty packaging and by greater regional reuse and recycling.

### Pilot Plant Planned

A regional disposal association is planned, the logistics of which must meet particular requirements. Packaging materials will have to be sorted according to their nature and quantity and a collection system will have to be set up; if the association is to be successful, each member of the disposal chain will have to assume major responsibilities within its own area.

As a step towards implementing its regional disposal strategy, the chemical industry has decided to use the pilot project on recycling used industrial packaging to acquire the necessary experience. The pilot plant planned for the project at the Hoechst AG Ruhrchemie factory at Holten, Oberhausen, at planning and construction costs of around 16.5 million German marks [DM] will adapt existing technology to the special requirements concerned, and optimize it in light of the experience acquired.

Industrial and commercial reprocessors of chemical products in the catchment area for the planned pilot project, which covers a radius of around 30 kilometers, will be provided with containers, such as skeleton crates and pallets, for the empty packaging. Once these containers are full, they will be collected by the pilot plant's employees and replaced with empty ones.

Packaging used for explosives and radioactive substances is specifically excluded from the disposal program.

### Technical Cycle

On arrival, the drums are checked and pretreated, after which they are sorted according to size, material, and degree of contamination.

Drums exceeding 120 liters in capacity are cleaned, dried, and checked for damage and degree of cleanliness. Cleaning takes place in semiautomatic washing booths, each of which offers a choice of two detergents. Hot or cold water is used as required, if necessary with the addition of detergent, though in special cases solvents or low concentrations of caustic soda are used. The cleaned drums are then reused. Damaged drums exceeding 120 liters in capacity and small drums are broken up, using wet-operated [nassbetrieben] rotary cutters, washed, and dried. The materials from the drums are then available, sorted according to type, as steel scrap or plastic shreds for recycling.

The polluted detergents are temporarily stored in tanks for external reprocessing, as is polluted washing water from the air exhaust purification unit. The various kinds of waste water are fed into appropriate water treatment units. Residue from pretreatment of the drums is incinerated as special waste.

The VIP-CI planning phase is scheduled for completion in 1992; it will be followed by a two year trial period during which packaging recycling will be tested and improved.

### Germany: Asphalt Scrap Used in Wet-Mix Macadam

92MI0181 Wuerzburg UMWELTMAGAZIN, No 11,  
Nov 91

[Article by Lisa Kiefer: Raw Materials From Used Asphalt Scrap—Bietigheim Ballast Works Breaking New Ground"]

[Text] Asphalt scrap, which occurs when roads are broken up or resurfaced, is almost always dumped. However, a new recycling process holds out the prospect of useful recycling for this material. Asphalt scrap in the form of crushed granulate can be admixed with wet-mix macadam in a proportion of up to 30 percent.

This process, which has previously been applied on an experimental basis in Germany, has now been developed by the Wilhelm Fink ballast works at Bissingen, Bietigheim, into a business division in its own right, which plans to produce a wet-mix macadam from a mixture of ballast, grit, and sand, with a 30 percent asphalt scrap content. Walter Fink, the firm's managing director, says: "Our wet-mix macadam is now on a par with the conventional product in terms of quality and durability."

At present, the new mixture accounts for only around 15 percent of the ballast work's total sales, though there are signs of a steady increase due to factors such as the new mixture's positive performance in initial state acceptance tests.

Following discussion with and examination by the Bietigheim am Neckar roads department and the Stuttgart district ground testing agency, the Land of Baden-Wuerttemberg's interior and environment ministries have given official approval to the Fink ballast works to admix asphalt granulate with wet-mix macadam.

However, the granulate mixture itself is no cheaper than pure wet-mix macadam. When road surface scrap is delivered, the ballast works levies a charge, added to which, says the owner of the firm, granulate production places considerable strain on the crushing machines. New techniques may well reduce this cost, however.

#### **Germany: Protection, Improvement of Water Resources Proving Costly**

92WS0183A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 2 Dec 91 p 10

[Article by sel.: "Water Pollution Control Will Cost Billions; New Construction Methods Have to Be Investigated for Sewage and Effluent Handling"]

[Text] Aachen—The future construction measures that will be required for water pollution control in Germany can be estimated at 100 billion German marks [DM] for canalization, DM50 billion for the improvement of sewage treatment plants and DM20 billion for precipitation water treatment for the old federal lands. A total of DM80 billion is to be reckoned for the same measures in the new federal lands. Dr. Klaus Imhoff of the Essen Ruhr Association pointed this out during a conference in Aachen attended by 350 scientists and specialists.

In addition, for the old federal lands, sewage system engineering practice has resulted in the fact that of the 400,000 kilometers of canalization 20 percent in the

public sector is to be overhauled. This will mean a cost of DM1250 per meter. For precipitation water treatment it is assumed that a third of the treatment plants are already finished. The clearing capacity must be increased considerably in the near future also in the old federal lands. The regulations concerning amounts of nitrogen and phosphates demand this. Based on the Ruhr Association's experience DM1000 per inhabitant are estimated for this. Sludge treatment is included.

One cannot fall back on statistical figures of this sort in the new federal lands. However, the professional association presumes that DM6000 per inhabitant will have to be invested for new equipment for canalization and sewage treatment plants. Only it is to be assumed that one third of the equipment is on hand and 20 million "population equivalents" will have to be disposed of.

Assuming a realization period of 12.5 years, it comes to an annual investment rate of DM20 billion. This is equivalent to four times the rate of investment made to date in the old federal lands. This huge effort will only be possible if, first and foremost, the approval authorities and operating companies think about how the approval procedure can be simplified, Imhoff believes.

For canalization, the damage situation is to be determined and estimated to begin with, and restoration is to be defined according to priorities. There is a big research requirement here, above all with regard to suitable construction methods and compatibility of materials. The interplay of precipitation water treatment and sewage treatment plants is recognized as a reciprocal relationship, but has still not been investigated sufficiently in detail.

Because the biological gradients for the new requirements will be at least four times as great as in the past and corresponding sites are often not available, a space-saving type of construction is more required than ever. Up to now aeration tanks were placed five meters deep. Today there are examples of a 10-meter reactor depth, but in this case flotation phenomena appear in the secondary settling tank. These have to be investigated and eliminated in the interest of the continuous separation of solid matter.

The sewage rate and the debated carbon dioxide rate will have further restrictions as a consequence, Imhoff believes. This is to be taken into account with regard to the sewage treatment process and sludge treatment. Because the authorities give preference to thermal sludge treatment, the usual individual processes of drying, incineration and sintering will have to be optimized in their interplay. Besides the investigation of individual processes, it is desirable to optimize these as a whole via the comparative analysis of process chains. However, this presumes a higher personnel effort.

**Germany: Soil Reclamation Deemed Successful**

92WS0188A Frankfurt/Main FRANKFURTER  
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT  
in German 29 Nov 91 p 8

[Text] Frankfurt—The biological cleanup of contaminated soil has passed out of the experimental stage. This was announced by G.A. Henke of the company Umweltschutz Nord in Ganderkesee, near Oldenburg, in an article in the magazine BIOENGINEERING (Vol 5, p 62). There are two possible processes available, on-site and off-site treatment of the soil. The decision about which of the two processes is preferred can only be made on a case-by-case basis.

In any event, it is important to closely examine the soil before treatment in order to determine the type and concentration of the contaminants, to homogenize the soil, to apply the microorganisms that are suitable for decomposition, and to continuously supervise the decomposition process, which takes place in closed bio-beds.

Under these conditions, it has been possible, for example, to make heavily contaminated soil in the vicinity of a fuel depot at the Hamburg Airport, containing very high concentrations of mineral oil hydrocarbons (3,000 to 4,000 milligrams per kilogram of soil), recultivable in eight months in bio-beds that were set up on-site in tents measuring 300 meters in length.

Even the soil from the premises of a former gas works containing up to 20,000 milligrams of polycyclic aromatic hydrocarbons per kilogram of soil could be stripped of 98 percent of its contaminants in only 32 weeks and be reused without any reservations whatsoever. Because of the highly non-homogeneous soil conditions, an in situ cleanup was not possible in this case. Thus, the 24,000 tonnes of soil to be cleaned up were first subjected to an in situ soil wash, after which the mud was dried out and microbially cleaned up at Umweltschutz Nord's soil treatment center.

Once contaminated soil has been cleaned up and it no longer exceeds the officially allowed values for contaminants, it is generally put back in its original location. Its content of contaminants is then so small that an ecological balance is immediately restored in the soil. This not only increases the fertility of the soil, but also creates conditions under which the remaining traces of contaminants are further decomposed, until the ground can no longer be distinguished from natural soil.

**German University Develops Bacteria-Based Pollution Test**

92MI0194 Bonn DIE WELT in German 23 Dec 91  
p 17

[Article by Silvia von der Weiden: "New Test for Contamination by Pollutants—Bacteria Just Switch the Light Off"]

[Text] Biologists have at last seen the light. Organisms that use part of their metabolic energy to luminesce have long been known; everyone is familiar with the phenomenon of bioluminescence, the name given by experts to describe the impressive display of light typical of glow-worms.

However, bacteria can also emit light, though the exciting idea of using these organisms to monitor pollutants, for example in sewage treatment plant effluent, is a new one. "Their luminescence serves as a criterion for the well-being of the bacteria," explains Professor Ulrich Winkler, a microbiologist at the Ruhr University, Bochum. "The luminous bacteria test provides a reliable laboratory process for monitoring the effluent draining out of the sewage treatment works into the outfall ditch."

*Vibrio fischeri* is the name of the remarkable organism that brings light to the murky, unappetizing effluent brew, and which will complement the established range of tests for effluents. Winkler describes its decisive advantage over previous biotests as follows: "Ideally, we should like to use representatives of the various food chains, so as to track the accumulation of the pollutants in detail. These bacteria seem tailor-made for this purpose owing to their position as the degrading organism at the end of all food chains."

The test is easy to use, and can be carried out using simple equipment in any laboratory. A small sample of effluent is taken, has the bacteria added to it, and is then diluted; after which the intensity of the light emitted by the luminous microbes can be compared with a previous control measurement. If the bacteria do not feel at ease in the effluent, they simply switch the light off.

One German and one American company are already offering canned live luminous bacteria for laboratory use. The process has been working successfully in the United States since 1979. Explaining the delay in starting to use this promising biotest process, Winkler says, "As the luminous bacteria test was standardized so recently, we now have to compare it with other effective pollutant monitoring tests." Meanwhile, control tests carried out with various detergents have shown "a high degree of reproducibility."

The bacteria's impressive luminosity can be traced to an enzyme, luciferase, which also occurs in other "luminous" organisms. A total of seven genes are involved in producing the light, regulating and shaping the complex display. Although the much-loved glowworms use light signals to seek a mate, scientists are still in the dark about the biological reason for primitive microbes' luminous behavior.

Since the bacteria do not only exist independently, but can also survive inside an organism admitting no oxygen, there is a theory that the light phenomenon provides a selective advantage over the less "conspicuous" fellows. Their luminous power makes the microbes difficult to overlook, and inside a host that is aware of their presence they find a well-stocked table.

It remains to be seen how seriously this theory, which at first sight seems to "throw light" on the question, should be taken. The fact remains that their ability to emit light has provided us with an easily used, inexpensive, and effective biotest that has already aroused widespread interest in industry.

This is because the range of applications for the bacteria test does not stop at effluent analysis: The process can also be used to test high-purity substances on a large scale and to analyze the pollutants contaminating derelict industrial sites.

### **German University Sets Silicon Chip Signal Frequency Record**

*92MI0195 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 11 Dec 91 p 4*

[Text] Researchers in Bochum have now attained the "dream threshold" of 30 gigabits per second for a silicon chip, thus confirming silicon's suitability for very high frequencies and simultaneously setting a new world speed record. The semiconductor device team led by Professor Hans-Martin Rein of the Faculty of Electrical Engineering at Ruhr University, Bochum, has recorded the highest signal frequency ever processed with a monolithic integrated circuit (chip).

The team developed circuits for future glass fiber communication systems and for high-speed metrology, which were then fabricated, using silicon bipolar technology, at Hewlett-Packard's factory at Palo Alto, California, U.S.A. The chips were assembled and tested in Bochum. A significant proportion of this work was undertaken by engineer Juergen Hauenschield. Using a time-division multiplexer and a demultiplexer, the team achieved processing speeds of up to 30 gigabits per second (30 billion binary characters per second). This is over 10 times greater than the transmission speeds of the fastest glass fiber data transmission lines currently in use.

This high operating speed, which even experts had not expected of conventional silicon technology (with no germanium added), had not previously been achieved even with chips made of considerably more expensive semiconductor materials. The Bochum researchers stress that no "exotic" laboratory techniques were involved in the silicon technology used, which is in fact currently making the transition to the production line. Besides the use of modern technology, these record results are primarily due to the fact that Professor Rein's Bochum team has for years been developing improved circuit design optimization processes and high-precision transistor models for simulating extremely fast circuits.

### **Siemens Executive on Solar, Fuel Cell, Nuclear Research**

*92WS0197A Stuttgart BILD DER WISSENSCHAFT in German Dec 91 pp 116-119*

[Interview with Hans Danielmeyer by Wolfgang Hess and Reiner Korbmann: "We Are Keeping All Avenues Open"]

[Text] *There are no patent recipes for energy conservation. Even though Siemens AG has since blossomed into a world renowned solar cell producer, its research director, Hans Guenter Danielmeyer, is firmly convinced that nuclear power still has a great future ahead.*

**bild der wissenschaft:** Research in developing new energy sources appears to have slacked off of late. Given the problems involved with decreasing resources and increasing damage to the environment, many questions remain unresolved. Has research in energy been put on the back burner in your company Professor Danielmeyer?

**Danielmeyer:** Just the opposite is the case. Its importance is becoming ever more dramatic. The demand for fossil fuels grows in direct proportion to the number of consumers, and the world population is constantly increasing. Moreover, the demands for power in the advanced countries continue to grow as well. We owe our thanks to the resolute work of our engineers for the improvements they have made in the operating efficiency of machines and power plants, thereby preventing even greater worldwide assaults on resources to satisfy energy demands. But that is the kind of work that is done quietly and lacks the spectacular aspect.

**bild der wissenschaft:** Yes, but in the presence of the planetary greenhouse effect, it would seem that spectacular measures are just what are needed. Ecologists and, finally, some politicians have recognized that carbon dioxide exhausts in Germany have to be reduced by at least 25 percent. As a major electrical company, what can you and what do you want to contribute to the solution of this problem?

**Danielmeyer:** Our core problem is the population increase. If we in Germany go all out to tackle the CO<sub>2</sub> exhaust problem while the rest of the world does nothing, it benefits no one. This is an international problem. It makes no sense whatsoever if any one country rushes ahead in this regard at prohibitively high costs, and, as a result, is no longer competitive internationally...

**bild der wissenschaft:** ...that is the political side. But you as a company are required to do something, inasmuch as you develop and market equipment that provides your firm a competitive advantage on the market.

**Danielmeyer:** In the case of our new GuD-power plants, in which a steam turbine is combined in series with a gas turbine, we were able to increase the plant's efficiency by 52 percent. By employing that technique we better utilize the raw materials and also spare the environment many exhaust fumes.

**bild der wissenschaft:** That was truly a wonderful jump forward, particularly since the efficiency levels had only risen by small increments for years. Many of us are now hoping for further advances, of course.

**Danielmeyer:** Improvements in the efficiency of power plants are so difficult to come by that progress has been very slow. It is quite another matter when an entirely different principle of generating electricity by means of fuel cells is used.

**bild der wissenschaft:** What do you mean?

**Danielmeyer:** The power plant converts natural gas into hydrogen, which is oxidized in a high-temperature fuel cell with oxygen. Electric current is directly generated in this chemical process. The attendant hot exhaust gases, chiefly carbon dioxide and water vapor, can then be used to generate even more electricity in conventional turbines. A further advantage of this system is its high degree of efficiency, even in smaller units.

**bild der wissenschaft:** You are referring to block-type thermal power stations?

**Danielmeyer:** Yes. Decentralized power supply can be expanded considerably by employing this technique. And, moreover, it has an efficiency of 65 percent relative to the electricity profits. But, to be sure, these plants too will give off CO<sub>2</sub>.

**bild der wissenschaft:** Could not nuclear and solar power plants eliminate the CO<sub>2</sub> problem? Your company is strongly represented in both segments, even internationally. What is the situation with nuclear power? You get the feeling that even the major power plant manufacturers have lost their enthusiasm for developing new reactors.

**Danielmeyer:** In our responsibility to the public, we are keeping all avenues open. Siemens is the largest producer of solar cells and solar system components in the world, with more than 20 percent of the world market. As before, we are determined to maintain our presence and our capabilities in the nuclear power sector, even if temporarily we have problems in obtaining new orders. Furthermore, we have recently strengthened our commitment by generating electricity from fuel cells.

**bild der wissenschaft:** All well and good. But if your company does not want to take on too many projects at the same time, you have to set priorities.

**Danielmeyer:** If we had a free hand, we would argue for more nuclear power. Naturally we are also trying to increase the fraction of regenerative energy sources that leave no residue behind. We have also pursued every avenue possible with respect to introducing power economies. Nonetheless, we shall also in the future continue to provide a good part of power supply from conventional fossil fuels.

**bild der wissenschaft:** But is there no preference for one or another method of producing electricity?

**Danielmeyer:** The problems are too complicated to permit that. You can't say "either-or." The total energy mix has to be optimized. And any politician who doubts this is ducking reality. We are living in luxury here. The

world population is continuously climbing. Energy use cannot be satisfied by patent recipes alone.

**bild der wissenschaft:** Despite that, I want to ask on which power sources we will be relying in the coming years.

**Danielmeyer:** On fossil fuels, but by the end of this decade we will again be relying on nuclear power more strongly. Nuclear fusion, at the earliest, will only be operational by the middle of the next century—that is if it ever goes on line.

**bild der wissenschaft:** What is the situation with photovoltaics?

**Danielmeyer:** If Central Europe wanted to obtain more electricity from solar cells, the large power plants simply could not afford the high costs for the surface areas required and the effort would fail. Even if the real estate costs were disregarded, solar energy is anything but cheap at the present time. One kilowatt hour of electricity from a conventional power plant costs the average user just 30 pfennigs, while a kilowatt hour of electricity from solar power costs two marks. Hardly anything has changed in that regard in the past years.

**bild der wissenschaft:** Does that mean that solar power will never be competitive?

**Danielmeyer:** It is a general rule in technology that the price of a product is reduced by half, when the number of such products produced increases by a factor of ten. These "economies of scale" are valid for steel just as for chips; they would also be valid for solar cells.

**bild der wissenschaft:** That means that if solar cell production moved from the 40 megawatts of today to 400 megawatts, the cost for one kilowatt hour of electricity, generated photovoltaically, would drop from two to one mark?

**Danielmeyer:** That is correct for the solar cell itself. But this really innovative element constitutes only a small fraction of the investment costs. Only the cell and the necessary electronics is subject to this learning curve. Everything else, maintenance and module, is conventional and therefore their costs cannot be reduced. On the other hand, legislation plays an important role. If the politicians force the price of fossil fuels sky-high, then solar energy would become much more competitive.

**bild der wissenschaft:** How much does Siemens currently lay out per year on energy-source research?

**Danielmeyer:** For research and development in the fields of power generation and distribution, we currently spend more than half a billion German marks [DM] per year. But that is only the amount that is directly allocated for that purpose. If we were to add to this everything else that—in its end effect—contributes to energy economies, e.g., traffic control systems, the broad use of video

conferences, or such unlikely things like the development power-sparing washing machine programs, we would arrive at a much higher figure.

**bild der wissenschaft:** Whoever purposefully wants to optimize energy use cannot therefore just limit himself to conduct energy research in the narrow sense of the definition?

**Danielmeyer:** Exactly. In actuality our activities in the field of microelectronics are also measures contributing to energy conservation.

**bild der wissenschaft:** Is conventional electronics doomed for extinction?

**Danielmeyer:** Not at all. We can improve the efficiency in locomotives and other heavy propulsive machines substantially by means of new current transformers. The replacement of resistance switches with thyristors also resulted in enormous energy savings.

**bild der wissenschaft:** To what degree have these potentials now become exhausted? Are we just at the beginning or have the economy measures resulting from electronics advances in energy systems been pretty much played out?

**Danielmeyer:** That is difficult to answer in generalities. You have to take each product separately. I do believe, however, that—all in all—we have already come a long way. I still see great potential, for example, in power generator load management.

**bild der wissenschaft:** You mean that the coordination between supply and demand in the matter of power generation can still be improved?

**Danielmeyer:** Yes. Of course, there must be no system breakdowns. In that regard, the Electricity Supply Enterprise's (EVU) present safety strategy is correct. The energy supplier could—by means of modern electronic load management—control those users, who need not stay constantly on the power net, in such a way that they are only connected up when there is an overcapacity. Many peak loads could be cut back in this way.

**bild der wissenschaft:** No one can be certain that these are the right solutions. How can you really make it clear that your energy-optimizing switches and devices are actually worth the investments?

**Danielmeyer:** International competition in developing better products that are friendlier to the environment comes to our aid. Whoever does not stay ahead in this regard will—in the course of time—lose his customers. That is the best guarantee that an energy-saving invention will find interested parties on the world market.

**bild der wissenschaft:** Are there other areas in which energy consumption can be substantially optimized within a few years?

**Danielmeyer:** Of course, there are other fields in which considerable energy savings can be made. But—and I repeat myself—the constantly growing world population negates these successes.

**bild der wissenschaft:** What has happened to heat pumps, which were so euphorically praised a decade ago?

**Danielmeyer:** The energy consumption of private households (in our country this accounts for more than a quarter of the total energy consumption) can still be reduced substantially through their use.

**bild der wissenschaft:** By about how much?

**Danielmeyer:** Recent studies indicate that about a fifth of household energy needs could be covered by heat pumps and solar collectors. Even with a one-time initial subsidization, these kinds of energy sources could be operated economically.

**bild der wissenschaft:** But why are heat pumps so out of vogue today?

**Danielmeyer:** The cost of heat pumps today, just as before, is higher than for units burning fossil fuels.

**bild der wissenschaft:** Will environment-friendly solar energy succeed, at least by the year 2100, in satisfying the world's energy requirements? In the broader sense, I include wind and water power.

**Danielmeyer:** Absolutely not. To be sure, we have not by a long shot exhausted all regenerative energy sources. But even all the world's water and wind power sources, when compared with today's demand for fossil fuels, is but a drop in the bucket or a puff of air. In a few years, the politicians will again be promoting nuclear power.

**bild der wissenschaft:** Even if that should occur, no intelligent politician would argue too strongly for nuclear power plants in their present design. He would be promoting new reactors, whose inherent safety would be much higher than at present. Industry no longer participates even in the development of high-temperature reactors, with their superior safety engineering standards.

**Danielmeyer:** If, like today, you can no longer sell a nuclear power plant, it is very difficult for a company to find the means for developing a completely new reactor line, the costs for which might run into billions. Nonetheless, our company's Kraftwerk Union (KWU) branch continues to raise the safety standards for nuclear reactors. The KWU leads the world in this sector.

Through our recently concluded cooperative agreement with France's Framatome, we are looking forward to a synergy effect that will result in the development of even better nuclear power plants.

I am convinced that we will have to return to nuclear energy as early as the next century.

**Germany: BMFT Funds Biomass Project**

92MI0200 *Graefelfing BIOENGINEERING  
FORSCHUNG+PRAXIS in German Dec 91 p 9*

[Text] Bonn—The Federal Ministry of Research and Technology [BMFT] intends to support combined heat and power stations fired by biomass in a pilot scheme intended primarily to demonstrate the economic viability of units with an output of up to about 40 megawatts. The BMFT says it will be making a total of around 30 million German marks [DM] available for the project over the next three years. Priority will be given to projects in the new laender.

The laender have large, concentrated areas ideal for economic biomass production. Some areas, especially in Brandenburg, are so heavily polluted as to be unsuitable for food production and would therefore have to lie fallow. District heating grids are also common in the new laender. A lot of power stations, especially smaller ones, require conversion from high-sulfur brown coal to other fuels, such as biomass, for environmental reasons.

The BMFT says that potential fuels for these stations are plants cultivated specifically to provide energy, such as fast-growing timbers and grasses such as ramie [Chinaschilf]. It will also be possible to add limited quantities of solid vegetable residue from agriculture and forestry.

Of the energy plants discussed, ramie stands out for its particularly high energy yield per hectare. But as fuel for the new pilot scheme it is only one of many candidates. The BMFT believes the grass holds out good prospects for the future, especially if the cost of the plant cuttings can be further reduced, although there is still a long way to go before ramie becomes an attractive plant for the farmer.

The Land of Brandenburg has already planted more than 100 hectares of ramie at 10 different sites in various regions and will be setting up a research facility of its own at a research center in Grossbeeren.

**Germany: Environment Research Center Established in Leipzig**

92MI0202 *Bonn BMFT Journal in German Dec 91 p 5*

[Text] The Leipzig/Halle Environmental Research Center (UFZ) will start work on 1 January 1992. An organizing committee has discussed and decided the purpose and structure of this new major research facility. The new center will improve the scientific basis for our understanding of the environmental problems of heavily polluted areas and so contribute to developing the methods and formulating the theories of ecosystems research. At the same time, the regenerative capacity and behavior of heavily polluted systems will be investigated. This will lead to findings regarding the technical and socioeconomic prerequisites for the rehabilitation and reconfiguration of land developed and cultivated by man

and for a long-term environment-compatible relationship with it. Another topic is the environmental compatibility of products and production processes (ecobalances). The UFZ will work closely with universities, non-university environmental research organizations, and industry. The BMFT [Federal Ministry of Research and Technology] is funding the UFZ and its 355-strong staff with approximately 40 million German marks in 1992.

**Germany: Non-Polluting Water Demineralization Process Developed**

92MI0203 *BMFT JOURNAL, Dec 91*

[Text] The Steinlach Water Supply Company is now using a particularly environment-friendly process to demineralize drinking water at the Kilchberg water works near Tuebingen. The special characteristic of the CARIX process is that it uses carbon dioxide, which is innocuous, as the process chemical. It reduces environmental pollution by about a half compared with conventional methods. In the ion exchange processes commonly used today, the calcium and magnesium ions responsible for the hardness of the water are attached to certain exchanger substances (synthetic resins). In exchange, these synthetic resins release the sodium ions from the regenerating salt into the water. If all the water at Kilchberg were softened in this way, 2,000 tonnes of regenerating salt would pollute the environment every year. With the new process, however, calcium and magnesium as well as the unwanted sulphate and nitrate ions are attached to two different ion exchangers, and only carbonic acid is given off. When the ion exchangers are regenerated, most of the hardness elements bound to them are precipitated as limestone or gypsum and only a small proportion goes into solution. The BMFT [Federal Ministry of Research and Technology] contributed about 1.47 million German marks (34 percent of the total cost) to the development of the process by the Karlsruhe Nuclear Research Center.

**German Industry Proposes CO<sub>2</sub> Emission Reduction Policy**

92MI0212 *Bonn TECHNOLOGIE-NACHRICHTEN  
MANAGEMENT-INFORMATIONEN in German  
18 Dec 91 pp 23-24*

[Text] The leading associations of German industry have submitted a paper containing their proposals on climatic protection to the federal government and to the EC Commission. The paper expresses the readiness of German industry to enter into voluntary undertakings on carbon dioxide reduction as a contribution to the solution of global climate protection problems. In industry's view, this would be a better way of protecting the climate than taxes or levies. It could also foster private initiatives that would transfer know-how and technology to both developing and European countries. However, the requisite resources would only be available if the

government refrained from taking them away from companies in the form of levies or taxes. A tax on energy or CO<sub>2</sub> would not ensure that money was invested where it was most needed.

German industry calls on the EC Commission and the federal government to give priority to voluntary, effective, industry-compatible measures in line with free market principles and efficiency criteria rather than to a coercive taxation-based strategy. Detailed legislation on heat use would be incompatible with these principles.

The proposed market economy approach would mean that politicians and industry would jointly establish realistic targets and leave it to individual companies to decide where and how to achieve them.

As a prerequisite, the priorities of national and EC energy policy should be clearly stated. An objective assessment of nuclear power and how it can help protect the climate is also required if a balanced energy mix capable of guaranteeing energy supplies is to be identified.

German industry believes that various solutions are conceivable, provided the federal government and the EC Commission are prepared to move in this direction:

a) Individual sectors commit themselves to increasing energy efficiency and thus contribute to protecting the climate. This does not prevent individual firms from making commitments along the same lines.

b) Individual firms or sectors commit themselves to taking appropriate measures in their own or others' factories or to taking other measures in Germany or worldwide to reduce climate-relevant trace gases by an amount to be established by the policymakers or to enhance the absorption capacity of sinks for these gases accordingly. The results that companies or sectors achieve worldwide in this context would have to count towards the reductions that they achieve on the domestic front.

Measures like these, adopted by industry on a voluntary basis, would meet climate protection targets and make taxes or levies superfluous.

If, nevertheless, a tax on energy and CO<sub>2</sub> were still introduced at European level, provision should be made for balancing results worldwide so as to take into account most effectively the global nature of the climate problem. In addition, the EC Commission's approach to this form of taxation needs significant changes.

1. The companies involved should have a legal right to exemption from the tax planned by the EC if they contribute to meeting the agreed trace gas emission reduction targets via investment or other measures (balancing). Companies must be free to decide where and how to implement these measures.

As soon as a company notifies the relevant governmental authorities that it is taking balancing measures, immediate provisional exemption from the tax must be granted.

If the enterprise provides verifiable evidence that the targets have been met through balancing measures, final tax exemption or reimbursement, according to circumstances, must be granted. The same applies in particular to balancing measures taken outside the EC.

2. Given the deadlines and tax rates envisaged by the EC Commission, the proposed energy/CO<sub>2</sub> tax would place an unreasonable and disproportionate burden on German industry.

Tax rates must be significantly reduced and deadlines must be set according to the reaction capacities of the companies concerned, otherwise the envisaged provisions will merely turn into fines.

At least five years must be allowed between the introduction of the levy and its actual implementation, as in the case of the German effluent levy, to enable companies to take measures designed to increase energy efficiency.

Similarly, the levy and tax rates should not increase yearly, as envisaged, but only in line with the measures taken by other OECD countries.

3. When formulating a European energy/CO<sub>2</sub> tax, the need to safeguard the environment and the climate must be balanced against and reconciled with the need to avoid distortions in competition, especially when assessing energy yield against climate-relevant trace gas emissions.

4. Even companies that are wholly or partially ineligible to take advantage of the balancing system must be allowed to offset the investments that they make to increase energy efficiency against the envisaged tax.

5. The envisaged energy/CO<sub>2</sub> tax must exempt the sectors that have already achieved a high degree of energy efficiency in their production processes by taking technical or organizational measures.

6. German industry presses for a uniform (that is, without separate scales and minimum rates) application of all the main provisions of the envisaged tax regulation, including sectorial or other exemptions, in all EC member states, and that its introduction should not affect tax revenues from existing taxation systems. This also applies to existing energy taxes and levies.

German industry believes that the measures put forward will make for more effective global climate protection than the current fiscal strategies confined to individual sectors of industry nation- or EC-wide.

### France: Structural, Financial Problems Delay Creation of Polar Studies Institute

92WS0212B Paris LE MONDE in French 3 Dec 91  
p 15

[Article by Yvonne Rebeyrol: "Creation of Polar Institute Encountering New Difficulties"; first paragraph is LE MONDE introduction]

[Text] An interministerial meeting is to be held on Tuesday 3 December at Hotel Matignon [residence of the prime minister] to finalize the charter of the French Institute for Polar Research and Technology-Paul-Emile Victor Expeditions. Announcements of its forthcoming creation have been renewed on several occasions, but have run into structural and financial difficulties.

The "forthcoming creation" of the Institute was announced on 14 February 1990 by Mr. Hubert Curien, minister of research and technology, and Mr. Louis Le Pensec, minister of DOM-TOM [Overseas Departments and Territories]. On 13 May 1991, Mr. Paul-Emile Victor, who had just been received by Prime Minister Michel Rocard, asserted that the Institute would be created "within some 15 days." With the departure of Mr. Rocard, the decision was again delayed.

Be that as it may, the future Institute has before it several urgent decisions waiting to be made. The first concerns the construction of the "Concorde" base in the interior of the Antarctic continent, at "Dome C" (1,000 kilometers from the "Dumont-d'Urville" coastal base, and at an altitude of 3,200 meters), plans for which are ready, and in which other countries are expected to participate. There, the thickness of the ice cap (4,000 meters), and its configuration, lend themselves favorably to the taking of deep core samples of the ice, from which the changes in climate and in composition of the atmosphere that have taken place over the past hundreds of thousands of years can be studied. Such studies could help in gaining a better understanding of future climatic changes.

#### Private Law or Public Law?

The Dome C Station is also indispensable to the physicochemical study of the mean atmosphere, and in particular to research on the variations in atmospheric concentrations of chloro- and nitro-compounds, in view of their importance to the future of the stratospheric ozone layer. And because of its altitude and the dryness of its air, the site will be particularly useful for observation of celestial bodies and phenomena.

The second urgent operation is the replacement of the "Marion-Dufresne." This ship has been supplying the three subantarctic bases on the islands of Kerguelen, Crozet, and Amsterdam at the southern end of the Indian Ocean, for almost 20 years. In addition, it is frequently used for oceanographic surveys in the Southern Hemisphere. It is even the largest French oceanographic vessel. And the Institute will also have the task of developing research in the Arctic.

The Institute will be a GIP [Public Interest Group]. But in the initial project, it was to have been operated under private law<sup>(1)</sup>, and its board of directors was to have consisted of representatives of the ministries concerned (Research and Technology, DOM-TOM, Transport); of the agencies concerned (CNRS [National Scientific Research Center], CNES [National Center for Space Studies], IFREMER [French Research Institute for Exploitation of the Sea], and Meteo-France); of the TAAF [French Southern and Antarctic Territories] overseas territory; and of the Association of EPF's [French Polar Expeditions]. This GIP was to have been linked to the TAAF's by an agreement, under which the first was to be in charge of the selection, coordination, and implementation of the scientific and technological programs; and the second was to be responsible for logistical facilities and infrastructures and for French sovereignty in the subantarctic territories.

But the project was put at issue again eight days ago by the Ministry of the Budget, which proposed new structures and a new mode of operation. Under the new proposal, the board of directors would include additional members (Ministries of Foreign Affairs, Environment, and Budget). The Institute would be managed according to the rules of public law, which are much more severe and constrictive than those of private law. Even in case of emergency, it could not hire any permanent personnel to complete its staff or replace its present civil service employees, all of whom are being provided by the CNRS. The bodies directly concerned with polar research (Ministry of Research and Technology, CNRS, TAAF, CNES, IFREMER, and Meteo-France) would no longer have the powers of decision; these would be the province of the new board of directors.

#### Footnote

1. The Institute's budget had been "guaranteed" as of October of this year. Its sum total of 113.4 million francs[Fr], was to have been funded for the most part, directly and indirectly, by the Ministry of Research and Technology (Fr78 million) and the Ministry of DOM-TOM (Fr34 million).

### France Approves Nuclear Waste Research Program

92WS0217A Paris AFP SCIENCES in French  
28 Nov 91 pp 30, 31

[Article entitled: "Mr. Strauss-Kahn Promises to Organize A Debate on Nuclear Policy in the Assembly"]

[Text] Paris—The minister of industry, Mr. Dominique Strauss-Kahn, confirmed 25 November during second examination of the bill on management of radioactive waste that "the government was committed to organizing a debate on nuclear policy" in the National Assembly.

The bill was passed on the second reading with 286 yes votes (cast by the SP/Socialist Party, plus 10 independents and five UDF/French Democratic Union members) and eight no votes. Two hundred and sixty-eight of the 562 voting deputies abstained, including the three opposition groups and the communist contingent. The former environmental minister Mrs. Huguette Bouchardeau (SP) did not vote. In response to a request from the deputies, Mr. Strauss-Kahn said that the government "promised to organize a debate on nuclear policy. We will then see if there is anything to legislate about," he said.

The bill on waste management provides for three research programs over the next 15 years on ways to eliminate long-lived and highly active radiowaste. Each will receive government funds in amounts that were specified by Mr. Strauss-Kahn: the first (3.6 billion French francs [Fr] over 15 years) concerns advanced after-treatment or transmutation, the second (Fr3.8 billion over 15 years) conditioning and aboveground storage, and the third (Fr4 billion over 15 years) deep underground storage at geological sites.

A twelve-member national evaluation committee will lead these studies to select a method for treating radiowaste. It will submit an annual report. Within 15 years at the latest, a comprehensive evaluation report will be presented, along with a bill authorizing the possible creation of a final storage center for very active, long-lived radiowaste.

The deputies adopted an amendment sponsored by Mr. Jean-Louis Masson (RPR/Rally for the Republic, Moselle) establishing the reversibility of decisions to store dangerous products underground. Storage authorizations will be good only for limited periods of time, and consequently will be able to include conditions for their revocation.

The National Assembly upheld several proposals introduced by the Senate, notably the ban on storing imported radiowaste in France for longer than needed to retreat it. It also upheld the principle of consulting with elected officials and with residents regarding any plans to install underground laboratories.

#### **French Electric Power Industry Presents Environment Plan**

92WS0217C Paris AFP SCIENCES in French  
28 Nov 91 pp 52, 53

[Article entitled: "EDF (Electricity of France) Presents Its 'Environment Plan'"]

[Text] Paris—The assistant general director of EDF, Mr. Remy Carle, presented the public company's "environment plan" on 27 November. The document is intended to educate EDF agents about and increase their awareness of environmental problems.

The 100 page plan reaffirms EDF's concern about the environment, which was already underscored in the environmental agreement it signed in 1982 with public authorities. It takes an industry-by-industry look at the assessed impact of EDF installations on air, water, wildlife and vegetation, noise levels, landscape, and safety and at the company's goals for that impact in the future. "We devour a great deal of space, and for that reason must have a much more positive approach to the environment," stressed Mr. Carle to the press corps.

EDF's activities affect a large portion of the territory. Indeed, its 538 hydroelectric plants alone cover 170,000 hectares, its classic thermal plants 4,000 hectares, and its nuclear plants 3,000 hectares. High and very high-voltage lines run a total length of 75,000 kilometers, only 1,680 km of which are installed underground. To this must be added hundreds of thousands of low and medium-voltage lines, tens of thousands of transformers, and other connection points, which together serve 27 million customers.

In its list of goals—which is long but "overlooks" renewable energy sources—EDF includes plans to install 60 percent of its new, medium-voltage lines underground by 1995. It will expand the use of wooden poles and dyed concrete for the remainder. The company will bring the quantity of its nuclear plants' radioactive scrap down to the level of its best-performing station, and "will maintain" the atmospheric pollution emissions of its thermal stations below the thresholds stipulated by European directives. Finally, EDF will undertake development of electric cars.

The most sensitive issue—protecting the landscape—will be the subject of partnership agreements with local communities aimed at eliminating the main eyesores. Unfortunately, it is still "technically impossible" according to Mr. Carle to bury very high-voltage lines. Yet those are the ones that excite the greatest opposition from associations and many local elected officials.

In this regard, EDF's insistence on running its line through the Pyrenean valley of Louron (Upper Pyrenees) seriously mutes its statements concerning the protection of nature and the landscape. Through his Ecology Generation movement, the environmental minister Mr. Brice Lalonde stigmatized EDF's 19 November appeal against the work suspension order handed down by the Pau administrative court.

Furthermore, EDF plans to build 2,400 new kilometers of very high-voltage lines between now and the year 2000. The company is already worried about the problems it is likely to run up against in installing this new forest of giant pylons.

#### **West European Environment Federation Created**

92WS0217D Paris AFP SCIENCES in French  
28 Nov 91 p 56

[Article entitled: "A European Federation of Regional Environmental Departments Is Created"]

[Text] Amiens—Officials of the regional environmental departments of Great Britain, Belgium, Spain, and France decided 22 November in Amiens to create a European Federation of Regional Environmental Agencies, Departments, and Ministries.

"The goals of the federation," spell out a communique of the Picardy Regional Council, "are to promote interregional technical cooperation on environmental issues through sharing of experiences and projects undertaken jointly. The network," the text adds, "is open to all European regions."

The decision was made at the regional environmental congress that was held 21 and 22 November in Amiens. The European regional agencies, departments, and ministries are invited next 24 February to Brussels "to get the first actions of this cooperative venture underway."

#### **France: Water Purification Research Launched** *92WS0218C Paris L'USINE NOUVELLE in French* *5 Dec 91 pp 76, 77*

[Article by Pierre Laperrousaz: "General Mobilization for Water Treatment—A Fr350 Million Program of Public and Private Sector Research"; first paragraph is L'USINE NOUVELLE introduction]

[Text] France intends to close its liquid-wastes treatment gap. La Generale des Eaux [General Water Company], La Lyonnaise des Eaux [Lyonnaise Water Company], and the public sector agencies are determined to develop the most effective possible techniques.

Twenty years of investments in the domain of water treatment have not yielded a notable improvement in the quality of France's rivers. The assessment made by the authors of the National Environmental Plan is severe. But no one would dream of questioning it.

The reasons for this paltry result are known: In France, only 30 to 35 percent of city sewage is treated, and the effectiveness of the sewage treatment plants leaves much to be desired. "In the best of cases, their performance barely permits the rivers to survive," says Michael Dutang, head of research at La Generale des Eaux. Massive investments in the construction of new plants will not suffice. Decontamination techniques must also be improved.

This is the object of the research that has been launched by the two big French water treatment companies, jointly with the public sector laboratories, and under the aegis of the Research Ministry. During the next four years, La Generale and La Lyonnaise plan to devote approximately 150 million francs[Fr] each, representing a 25 percent increase over their current outlay on water treatment research! But it should be noted that one third of the outlay will be subsidized by the public sector. The CEMAGREF [National Center for Agricultural Mechanization of Rural Engineering of Waterways and Forests]

and IFREMER [French Institute for Research on Exploitation of the Ocean], for their part, will spend Fr25 million each. The Ministry of Research will subsidize the program to the extent of Fr110 million.

#### **Characterizing the Pollutants**

Before purifying a waste water, the substances to be eliminated must be determined and measured. The objectives of the "water quality and purification" program reflect this dual concern. A first phase will be devoted to characterizing the pollutants, their evolution in the natural milieu, and their impact on the method of treatment. A second phase will concern the improvement of purification methods.

All the experts agree: The parameters being used today to characterize a pollution level are too roughly defined. For a long time, it was considered sufficient to account for matter in suspension and organic matter, measured in terms of the consumption of oxygen necessary for their degradation (BOD [biochemical oxygen demand] test and COD [chemical oxygen demand] test). Then, nitrogen and phosphorus tests were added. "These are still insufficient for improving the processing," says Francois Damez, deputy manager of research at La Generale.

New parameters must now be integrated that are representative of all aspects of pollution, their method of treatment studied, and their impact on the natural milieu evaluated. These include micropollutants, for example, such as chloro-solvents, microorganisms, certain nonbiodegradable forms, episodic pollutants introduced by storm waters, etc. This will make it possible to construct more complete computerized models, with a view to optimizing the design of purification plants and their operation.

The objective is clear: "The treatment of waste waters must yield innocuous by-products that can be assimilated by the natural milieu." A number of tools are currently available, but they must be improved. The biofilter, for example, in which organic pollutants are digested by "embedded" bacteria and not in a "free" culture medium, as in conventional plants, has made it possible in recent years to considerably increase the efficiency of bacterial purification. But it must still be modeled in order to improve its performance and computerize its control in process. This involves also the development of reliable in-process sensors. The mediocre performance of existing purification plants is owing in large part to the impossibility of regulating the real-time, in-process control of their operation, in the absence of adequate means of measurement and of instruments enabling simulation.

#### **Proliferation of Techniques**

"The biological processes are difficult to regulate, and measurements are complicated by the aggressivity of the milieu," says Thierry Chambolle, director of research at

La Lyonnaise. An example of a problem that "quite simply" must be resolved: the fouling up of the sensors.

For pollutants such as bacteria, viruses, algae and pesticides, chloro-solvents, etc, the biological method is not sufficient. Other techniques must take over. Like the coupling of the bioreactor with filtration by membrane, a specialty of La Lyonnaise, by which microorganisms and suspended matter are eliminated. Then, there are advanced oxidation techniques, a specialty of La Generale, for cases of pesticides and other toxic molecules. "Ozonization alone is no longer deemed sufficient," says Francois Damez. "It must be associated with other oxidants such as hydrogen peroxide and ultraviolet rays, and must work in the presence of catalyzers." The objective—to find a process that works with the greatest number of pollutants and yields the least offensive by-products. The ideal, of course, would be to degrade everything in carbonic gas and water! De-pollution is good; avoiding pollution is even better. The "water quality and purification" program does not overlook this aspect of the matter. It takes cognizance of the Eureka ISMAP project launched this year by La Generale jointly with the manufacturers of pesticides and fertilizers. The entire life cycle of these products will be studied, from their manufacture to their destruction in the water-treatment plant, including the mechanism by which they transfer into soils and their assimilation by organic plants. Based on these studies, it is hoped to be able to develop fertilizers that are more easily assimilated by plants, and pesticides that are less toxic and more easily degradable.

It may well be that some day, as Jacques Chirac once promised, we will be able to swim in the Seine downstream from Paris. That would be the most welcome demonstration that French technologies are capable of addressing a water-treatment world-market estimated at something like Fr1 billion.

[Box]

**Participants in Water Quality and Purification Research Program**

**CEMAGREF (Fr25 Million) and IFREMER (Fr25 Million)**

- Micropollutants, nonbiodegradable organic matters (CEMAGREF), pathogenic microorganisms, pesticides (CEMAGREF).

**LA GENERALE DES EAUX (Fr150 Million)**

- Micropollutants, nonbiodegradable organic matters.
- Pollution by influent waters.
- Instruments for surveillance and warning of water quality.
- Analysis and treatment of pesticides (Eureka ISMAP).

- Biofilter improvement and modeling (Eureka Simbiose).

- Advanced oxidation techniques.

**LA LYONNAISE DES EAUX (Fr150 Million)**

- Micropollutants, nonbiodegradable organic matters.
- Study of a matrix representative of water pollution.
- Membranous bioreactor.
- A compact purification plant characterized by enhanced performance and integrated with the environment (Step 2000-Water).
- New method of treatment of sludges (Step 2000-Sludges, Eureka).
- Lowering of nuisance levels (noises, odors) of existing purification plants.

**Solar/Hydrogen Energy Project in Bavaria**

92WS0221A Duesseldorf *HANDELSBLATT in German*  
4 Dec 91 p 33

[Article by Bernd Genath under the rubric "Renewable Energy": "Hydrogen: Nitrogen Oxide Problems Remain for the Present; Pilot Project in Neunburg: System Optimization Moving Along"]

[Text] 3 Dec 91 (HANDELSBLATT-TL)—The first plant in the world in which all the system elements of a future solar/hydrogen economy are being tried out in their interaction on a practice-oriented scale is in Neunburg in Bavaria. The project of Bayernwerk and its German industrial partners is now entering the optimization phase for its system components.

Theoretically the solar energy radiated onto the earth in a half an hour could cover the world's annual primary energy requirement. Unfortunately, the low energy density and the strongly fluctuating supply between day and night, between winter and summer and between northern and southern latitudes do not meet today's key requirements for a rewarding solar harvest. Nevertheless, power economics and research are including the direct utilization of solar energy in their alternative plans. The solar/hydrogen project in Neunburg outside the forest in Bavaria has now, after the conclusion of phase one, traced out the next steps in the research.

The operator of the plant is Solar-Wasserstoff-Bayern GmbH [Solar/Hydrogen-Bavaria Limited-Liability Company], a joint venture of the Bayernwerk company (60 percent share) and BMW, Linde, MBB and Siemens, each with a 10 percent share. The company was founded in 1986 expressly for this purpose. The total cost of the first phase of the project, which ended this month, runs to about 65 million German marks [DM]. The Federal Research Ministry and the Free State of Bavaria are sponsoring the grants portion of the work together with 50 percent. The symbiosis of the sun and hydrogen

bridges the gap between "random" solar heating and controlled terrestrial exploitation. This bridge is supported by quite a few piers:

1. Primary energy (the sun).
2. Current (photovoltaic).
3. Hydrogen (electrolysis).
4. Heat (combustion process).
5. Current (fuel cell).

This chain makes it clear that hydrogen is nothing other than derived energy and therefore basically can take the place of no primary fuels.

Another shortcoming: The combustion process with oxygen develops hard-to-control temperatures of a few thousand degrees. This temperature level can be lowered with air instead of oxygen as the second fuel parameter. But air consists of up to about 70 percent nitrogen. The result would be intensification of the nitrogen oxide problem, because a hydrogen and air mixture develops still higher temperatures than the customary fuels.

However, in spite of all the obstacles and efficiency loss that occur in each stage of the chain, the fascination of this process lies in the ideal picture of a future power supply: a power system based on solar heat and hydrogen that consumes no raw materials in operation and produces practically no pollutants and no CO<sub>2</sub>:

The solar/hydrogen cycle stores photovoltaically generated current in hydrogen, as water is separated electrolytically into its components, oxygen and hydrogen. The fuel hydrogen in turn combusts with oxygen to water, which closes the cycle—more correctly, the terrestrial cycle is closed, because the sun does not regenerate in this process.

#### Ludwig Bolkow as Initiator

The founder of the MBB concern, Dr. Ludwig Bolkow, proposed the plant in Neunburg outside the forest. He called the partner Bayernwerk and the Power Plant Union to a table for the first time in 1986 and discussed the project with them. The cornerstone ceremony followed in 1988, and current flowed from the photovoltaic plant into the electric mains for the first time as early as 1990. The first plant in the world in which all the system elements of a future hydrogen economy are being tried out in their interaction on a practice-oriented scale is in Neunburg.

The equipment is made up of the following components: two photovoltaic units having a total power of around 280 kW, two water electrolyzers having around 210 kW of total electric power, remote units for gas treatment, compression and storage, two fuel cells, two gas heating boilers for heating, and a liquid hydrogen filling station for experimental power-propelled vehicles. The fuel cells have a battery character, as they recombine the hydrogen

and oxygen in a kind of reverse electrolysis and in so doing liberate again the electrical decomposition energy input earlier into the electrolyzer. The photovoltaic plant, occupying just under 3000 square meters, has operated without problems up to now. The various external influences on the unit have been found to be noncritical. For instance, it survived unharmed even the severe storm in the spring of 1990 with top wind speeds of up to 160 km/h.

Both electrolyzers, which draw their current from an expensive and very flexible electric power processor, went into operation for the first time in April 1990. Both units are dependent on a supply of high-purity demineralized water. Both release, practically unpressurized, the gas produced. Their characteristic feature is their high efficiency of over 80 percent under their rated full load. By comparison conventional units operate with efficiencies of only around 60 to 65 percent.

The gases produced—hydrogen and oxygen—flow into pressure tanks, the storage of hydrogen being designed for a capacity of 5000 Nm<sup>3</sup>. Two tanks having a capacity of 80 m<sup>3</sup> each are sufficient because of the 30-bar compression. The oxygen, on the other hand, is stored only for particular experiments.

#### Cost Reduction Expected With Solar Cells

Two prototypes of gas heating boilers having a thermal power of 20 kW each are utilizable. The first prototype burns in the mixing mode hydrogen/natural gas with pure oxygen, and the second prototype the same mixture with air.

The first phase concerned itself mainly with tying the individual system elements into the process. Optimization of these components is reserved for phase two. It will run to 1996 with an estimated cost frame of around DM80 million. Some changes are planned:

In the area of the photovoltaics, doubling of the solar cell unit is being contemplated. In this connection the plan is to use "third-generation" solar cells, i.e., mainly amorphous-silicon semiconductors. A significant cost reduction is expected in the longer term from this technology. Of course, engineers also still disagree about the quality and efficiency of individual photovoltaic materials.

Moreover, Neunburg must settle the matter of which technology and which fabrication process are the right ones—whether the single-crystal, or polycrystal, or thin-film technology on an amorphous base, or even the new CIS technology. Bayernwerk is optimistic that thin-film engineering is the right way to go. However, the efficiency loss associated with this technology, that CIS cells clearly avoid, still causes concern.

The installation of a newly developed pressure electrolysis system will, in addition, permit hydrogen production under elevated pressure. New types of diaphragms in the electrolyzers as partitions between the substances obtained promise over and above this high efficiency

going in the direction of 90 percent, because they also prevent the consequences of a gas exchange.

### Wind Energy Projects in Northern Germany

92WS0221B Duesseldorf *HANDELSBLATT* in German  
4 Dec 91 p 33

[Article by Lutz Bloos under the rubric "Wind Energy": "Decentralized Generation of Electricity Requiring Enlargement of Power System; Wind Energy Converters With Vertical Rotors Provide Many Benefits; Bird Protection Protest; Tapping Electric Current From the Cool Wind on the Coast"]

[Text] 3 Dec 91 (*HANDELSBLATT-TL*)—The generation of electricity from wind has made strong advances in the last two years. The capacity installed in Schleswig-Holstein and connected to the power system has increased 10-fold during this period. The federal government's 250-MW promotion program provided the final impetus for this development. After this the share will come at first to 1 percent of electricity consumption in the windiest federal land.

The dramatic warming of the earth by greenhouse gases, especially CO<sub>2</sub>, predicted for the coming decades is the reason for the worldwide increasing efforts to produce energy from renewable sources. That is why the federal government wants to reduce CO<sub>2</sub> emissions about 25 percent by the year 2005. The federal government's promotion program also has to be put in this context, which for one thing is to accelerate the progress of electricity generation by means of wind power, and for another is to help German firms to acquire the appropriate know-how, so that they can build up production capacities for export also.

Schleswig-Holstein's energy minister, Gunther Jansen, placed strong emphasis on wind power one day after the end of the Husum Wind Power Days at the end of September: He put into operation on the North Frisian coast Germany's largest wind park with a total of 50 converters. However, now that the commercial exploitation of wind power appears to be getting under way, obstacles and bottlenecks are beginning to show that thus far were not foreseen and also were not expected from these corners. For instance, bird protectors fear harm to protected coastal birds, and their being driven away from traditional breeding grounds if wind parks are constructed in the vicinity.

A technical restriction on the exploitation of wind power came up for discussion during the congress: the limited capacity of the available power system. Whereas till now the electricity suppliers generated electricity centrally and distributed it up to the last farmstead, they have to collect increasingly non-centrally generated electricity and feed it into the power system. However, the available power system is only partly suited for this, because many small consumers and prospective wind-power electricity generators, like individual farmsteads, lie at end points of the power system that have just a low capacity.

The capacity at the supply terminals into the power system accordingly sets a limit for the size of a wind park or the number of them. A lot of wind stations can be developed optimally only when the power system has been appropriately strengthened, as Wolfgang Weidemann of the Schleswig electricity supplier explained. For instance, only two windparks, each having 10 300-kW wind converters, can be constructed at a favorable wind location on the west coast of Schleswig-Holstein, though the municipalities having jurisdiction have okayed locations for 10 wind parks. Hundreds of installations could generate electricity economically without state support at Rugen, an ideal location for wind power stations, if the power system were equipped appropriately. However, there are other concerns at present in Mecklenburg.

Petra Mann of the Julich Research Center, which collected the applications, assessed them and decided on support, explained the status of the 250-MW program. For instance, 2634 applications for the construction of 4758 wind power units having a total power of 611 MW had arrived in the middle of September. However, of these, 588 applications for 1016 units having a total power of 117 MW were rejected for various reasons already at this time. Two hundred and forty units supported by funds from this program and having an installed power of 26 MW were in production. The average size of the units applied for has grown from 80 to 130 kW since the start of the program and is still growing.

A manufacturer from the wind-poor interior with a totally new conception has just trodden new technical ground in the generation of electricity by means of wind power. The Heidelberg Motor firm of Starnberg introduced a vertical-axis rotor that could change wind power engineering radically.

The newly developed wind converter operates with a vertical-axis rotor. The rotor blades are positioned vertically and generate electricity without a gear unit in a traveling-field generator at the masthead. Only the H rotor and the generator's permanent magnet are moved mechanically. A gearbox, rotor blade adjustment and wind following, and costly and essentially wear- and trouble-prone parts of conventional wind converters are not required. A 300-kW unit has been generating electricity since the middle of September 1991 at the testing field in Kaiser-Wilhelm-Koog [Kaiser Wilhelm Polder] in North Friesland.

A 20-kW unit with an H rotor has passed its hardening test since January 1991, but for supplying the German antarctic station. "The misgivings we had have not materialized," explains Dr. Bernhard Richter, wind power department head of German Lloyd and at the same time chief executive of Windtest Kaiser-Wilhelm-Koog GmbH [Limited-Liability Company]. "We were afraid that condensation water would perhaps collect in the generator opening and bring the electricity generator to a standstill," he continued, "but there were no problems under any weather conditions." A 20-kW

rotor is supplying the Alpine Mountaineering Club's Rotwandhaus [Red-Walled House] in the Alps with electric power under likewise extreme conditions.

A commercial-size three-blade rotor having a rated power of 300 kW has a diameter of 31 meters and a hub height of 31 meters and has a disk area of 755 m<sup>2</sup>. The described area of the disk is the critical parameter for the unit's power. Typical survival wind speeds are between 50 and 55 m/s, which are reached only in exceptional cases on the German coast even in Spitzenboen. The 280-kWh rotor in the testing field has two rotor blades, each 21 meters long, and a rotor diameter of 32 meters. This results in a rectangular surface of 672 m<sup>2</sup>. The survival wind speed is specified as 71 m/s.

Measurement results for the electricity harvest as compared with conventional plants are not yet available, because unplanned outage times over a longer period also have to be taken into account. However, lower construction and maintenance costs for the technically brilliant simple converter represent an important advantage over conventional systems. In addition, the blade speeds are lower, so that noise generation is lower. H rotors will be installed on tripod masts in the future.

In spite of the advances that the exploitation of wind power has made in past years, Uwe Carstensen, chairman of the congress organizer, the German Society for Wind Power, is rather skeptical. Its aim to get 10 percent of the total consumption of power in 15 years from the wind and sun appears unrealistic to many. What is more, it is to be 25 percent in 35 years and 75 percent in the year 2050. Besides, our economy's total power consumption would have to be halved by the year 2025 in order to reduce effectively anthropogenic influences on the climate. Carstensen is relying on the recommendations of the German Federal Diet's study committee and thinks it is possible to implement a proper program with an effort of less than 1 percent of the gross national product.

However, a look across the border northward shows the following: The Danes are again several steps ahead of the Germans when it comes to exploitation of the wind. The first offshore wind park with 11 commercial-size converters with a rated power of 450 kW, each has been producing since August 9. The park was built by the power supplier Elkraft. Ten percent of the total cost of 21 million German marks [DM] comes from EC funds for the promotion of renewable energy. The water depth on the north coast of Lolland comes to only 2.5 to 5 meters. Still the foundations, with a total weight of 1100 tons each, had to be designed to be quite massive. The expected yield of electricity is 12.5 million kWh/year, which satisfies the demand of roughly 3500 households. The operator expects an approximately 30 percent higher yield of electricity at this location than at onshore locations.

### Matra Forms Composite Materials Recycling Group

92WS0236C Paris AFP SCIENCES in French 5 Dec 91 p 53

[Article: "Plastic Waste Recycling Group"]

[Text] Paris—Matra Automobile and five industrial partners have just created a group whose purpose is to eliminate the dumping of waste composite materials and encourage their systematic recycling, the group announced on 2 December.

According to its communique, the VALCOR (Exploitation of Composite Materials by Recycling) group will be involved in recycling of unsaturate polyester-matrix composites and/or derivatives (SMC [Sheet Molding Compound], BMC [Bulk Molding Compound], CIC [Consulting Engineers Company]). In addition to Matra Automobile, it includes ECIA (PSA [Peugeot] group), SMC, Manducher, Inoplast and Menzolit, which together account for 60 percent of French production of preimpregnated materials (SMC) and compounds (BMC, CIC) and more than 45 percent of the parts cast out of those materials.

### European Scientific Council to Present Environmental Agenda at 1992 World Summit

92WS0245B Paris LE MONDE in French 18 Dec 91 p 12

[Article by Martine Barrere: "Environment in the Whirl of Progress"—first paragraph is LE MONDE introduction]

[Text] Close to 250 scientists met in Vienna (Austria) to prepare the Earth Summit to be held in June 1992, in Rio de Janeiro, under the aegis of the United Nations.

According to Maurice Strong, general secretary of the Earth Summit's Rio conference, the main stakes will be to "set the foundation for a global association of developing and more industrialized countries, based on their mutual needs and common interests, to provide for the future of the planet." The underlying issue is how to "achieve a viable and equitable balance between environment and development."

But this mobilization does not occur just at politicians' level. It also involves many other players: women, manufacturers, members of non-governmental organizations, and scientists.<sup>1</sup> Thus, the International Council of Scientific Unions (ICSU) was officially asked by the United Nations to define "a scientific agenda for the next two decades, concerning matters pertaining to the environment and to development."<sup>2</sup>

On this occasion, the ICSU gathered scientists in Austria—from the natural to the social, and including the medical and engineering sciences. The working groups

explored three major themes: environment and development problems; understanding the Earth system; and, finally, science's contribution to political strategies.<sup>3</sup>

After the debates, two major series of recommendations were formulated. The first one deals with the research required to understand, monitor, and predict scientific phenomena.

We can mention, at random, the identification of changes resulting from natural fluctuations or induced by man's activities, the prediction of regional climate variations, the evolution of coastal areas, the setting up of epidemiological studies related to various diets and nutritional states, or again the development of parameters to measure the quality of life. The second type of recommendations deals with relations between science and politics. For instance, it appears necessary to organize an international forum to strengthen the ties between scientists and development agencies, to increase considerably the number of competent institutions and individuals involved with the environment, to work out an institutional mechanism to take into account the constant progress of scientific knowledge, etc.

#### The Cry of Alarm From Stockholm

Many sectorial symposia have already taken place as a prelude to the Rio conference; others are expected. But the Vienna symposium was unique in that it clearly showed that laboratory science, industrial science, bureaucratic science, science with its multiple facets as it has evolved since the 18th century, was losing its bearings.

Already in 1972, scientists meeting in Stockholm under the aegis of the United Nations to discuss man's environment had warned about the planet's ecological imbalances. In fact, scientific analyses were showing a deterioration of the environment on local and sometimes regional scales. It was also scientists that provided the impetus for the first government policies on the environment. These aimed mostly at limiting the negative impact of industrial development, but without questioning development.

During the 1970s, with the beginning of the crisis in northern industrialized countries and the rise of unemployment, ecological concerns took a back seat to the acknowledged need for economic growth. In 1987, a document entitled "Our Common Future" precipitated the awareness of the new relations that man had to establish with the environment. Written at the request of the United Nations, under the editorship of Mrs. Gro Harlem Brundtland, the current Norwegian prime minister, this report popularized the scientific discoveries of the 1980s. Some had shown the existence of worldwide ecological imbalances such as the hole in the ozone layer, the increased hothouse effect, soil deterioration, and the impoverishment of biodiversity. Others had demonstrated that changes in the planet's ecology were the result of man's activities.

Our uncertainties are considerable, scientists said in substance, but our certainties are more than sufficient to advise politicians that it is time to do something. For instance, at the scientific conference organized in Bergen (Norway) some time after the publication of the Brundtland report, the British geologist J. MacNeill stated: "Some day, scientists may find a perfect explanation for these phenomena. But, considering the nature of issues such as global warming, the last piece of the explanation will be provided long past the last day when we can try and do something."

It was also in the Brundtland report that the expression "sustainable development" appeared. Sustainable, bearable, durable, viable, livable. The French language still hesitates as to the best translation of this adjective. However, merely using it implies that the decisions made concerning development should respect the environment, mankind, and future as much as present generations.

For the first time in history, therefore, it was acknowledged that the concept of development is inseparable from that of ecology, and that it must be considered on a worldwide scale. In 1991, in Vienna, scientists went one step further. They pointed out, conversely, that the scientific problems of the environment were inseparable from development.

Actually, one crucial problem facing research is to determine how ecological imbalances vary with time. On this factor depend the urgency and scope of restructuring measures as well as evolution in time, which itself is intimately related to development modes. It also became apparent that solving the problems related to ecological imbalances will require all the available scientific expertise—human sciences thus gained recognition—and all the carriers of traditional knowledge, users of technologies, consumers of resources, etc.

#### New Responsibilities

As the Austrian sociologist Helga Nowotny clearly indicated, "the science of the 20th century must return to society and find mechanisms to fulfill its new responsibilities." This statement would have caused an uproar of most scientists only 10 years or so ago, leaving the others indifferent. In Vienna, the assembly approved it, although it included an abundant number of representatives from the natural sciences.

It is true that, throughout the debates, scientists from developing countries strove to show that the scientific truths of the North were far from being viewed as such in the South. And the vehement interventions of the Senegalese sociologist Khady Fall to explain the basic part that women should play in the implementation of "sustainable" [livable] development were not laughed at by anybody.

Designing a new contraceptive pill, inventing energy-saving technologies, developing new agricultural methods: all these efforts are unlikely to meet existing

needs and provide usable products unless women adhere to the projects and help define them. More broadly, the advice of the Vienna conference specifies that "science must strive to improve the public's understanding of scientific principles, and promote the taking into account of its interests and its culture."

### The Scientist's Duty

To what extent will the recommendations of the scientists gathered by the ICSU be followed in Rio? The political and economic stakes are so considerable that they will probably be the determining factors in the conventions that are expected to be signed. These will mostly aim to restrict the use of gases producing a hothouse effect, to protect biodiversity, and to save the tropical forests.

It is likely that no significant international agreement will be signed considering how keen oppositions are, in particular between North and South countries. But the Rio meeting, and the preparations that precede it throughout the world, show that ecological and political issues are closely interwoven. The ICSU president, Mambillika Lathil Menon, made it a point to emphasize this fact in his closing speech. "Our duty as scientists," he said, "is to intensify our efforts to play our part in the increasing interactions between science, governments, international organizations, and the world of trade and industry."

Certainly, we could have expected more from the Vienna conference. It is disappointing that the intensity of the debates did not yield more concrete commitments. It is also regrettable that the openness and informality of the discussions were not accompanied by a critical look at the inefficiency of the efforts that have marked the progress of the environmental sciences in the last 20 years, and of the international institutions that were created along the way.

The few tens of scientists that went to Vienna nevertheless seemed irreversibly engaged on the road opened by the Norwegian prime minister. "It is," he [sic] reminded them, "scientific discoveries and technological knowhow that have given us the power to alter nature and the ability to destroy life on earth. Science and technology must now help solve the problems." They still have to convince hundreds of thousands of their colleagues that this is right, and to implement a new kind of science.

### Footnotes

1. Some 1,000 delegates representing non-governmental organizations from all over the world were invited by the president of the Republic to meet in Paris, on 17-20 December, at the La Villette City of Sciences and Industry.

2. The International Council of Scientific Unions is a non-governmental organizations. Its members are science academies and research councils, as well as scientific unions. It sponsors, for instance, the World Climate

Research Program (WCRP) and the International Geosphere-Biosphere Program (IGBP).

3. Theme No. 1: primary factors affecting population and the use of natural resources, soil deterioration, industry and waste, energy, and health. Theme No. 2: global cycles, atmosphere and climate, marine and coastal systems, land systems, fresh-water resources, biodiversity. Theme No. 3: quality of life, public awareness, implementation of human and institutional expertise, technology policies, institutional arrangements.

### France: CEA to Disseminate Environment Research

92WS0256D Paris AFP SCIENCES in French  
12 Dec 91 pp 32, 32

[Article: "CEA To Coordinate and Valorize Its Environmental Research"]

[Text] Paris—On the strength of the research it has been conducting in its laboratories on a somewhat wide-ranging basis to date, the CEA [Atomic Energy Commission] has decided to coordinate, develop, promote, and disseminate its capabilities and technologies for the benefit of the environment. To this end, and upon recommendation by Mr. Robert Dautray, its science director, the Agency has named Mr. Alain Chedin to head its Mission Environment, with the title of Science Adviser.

To date, the Agency has been known mainly for its research in the nuclear field. But a nuclear involvement necessarily entails research into the effects of this type of energy on the surrounding environment: Air, water, living matter, both vegetable and animal, and ecosystems.

According to Mr. Chedin, 52, "There is a formidable potential of knowledge in environmental research within the CEA, at the basic, applied, and even industrial levels," inasmuch as research has been conducted there for years, not only on the safety of nuclear installations, the potential consequences of nuclear accidents from the standpoint of radiation protection, the biological effects of radiation, and nuclear waste products, but also on changes in the atmosphere, the oceans, seismology, vulcanology, lightning, marine and fluvial environments, the transport of matter in air and in waters, etc.

This gives some idea of the multidisciplinary nature of the Agency's research work, the number of instruments and measuring devices that have had to be developed for work in extreme nuclear and temperature environments, and the knowledge that has been acquired in the geology, seismology, and geodynamics inherent in the safety of underground nuclear tests, for example, at Mururoa and Fangatofa.

It was deemed advisable for the CEA to "make known its many-faceted work in these fields" and, rather than

continue its research in an isolated manner, to coordinate and develop it on the basis of cooperation not only with other French but also international organizations. "The equipment developed in connection with measurement, robotics, models, and crisis management situations, can find applications in all domains of the environment, from studies of the planet's climate to the measurement of ocean currents, and the tracking and treatment of pollution," said Mr. Chedin.

Industry can benefit from it, as can the fluvial basin agencies, and the enterprises involved in the processing of toxic wastes. The range of CEA capabilities can also facilitate, by way of the data processing equipment available to it, the modeling of the climate, of the greenhouse effect, etc. Indeed, the CEA can help in the protection of the environment in all its aspects. Actually, its relations with Mr. Brice Lalonde's Ministry, and even with the Greens and environmental circles, have greatly changed. Their mutual distrust has diminished.

Mission Environment plans to launch a three-year program of CEA activities and to organize a "two-day symposium on the CEA and the environment" in March, in order to "know the viewpoint—critical or not—of all the players in the organization." One objective behind all of this: The compiling of a "Blue Book" to be published around the end of April 1992, and the starting up of new research projects during the second half of that year, including two or three "very spectacular ones on topics in which the CEA is tops," concerning, for example, a study of the climate.

Being awaited, in this regard, is the forthcoming creation of a climate and environmental modeling laboratory under the science directorate specializing in this aspect. Using improved data processing facilities, such as, "Connection Machine 5" computers, the most powerful available, this laboratory could compare the results obtained in studies of the climatic changes that have occurred over the past 160,000 years. The CEA has been conducting such studies using core samples of ice provided by the Soviets and taken at their Vostok station in Antarctica.

To no extent whatever is Mr. Alain Chedin excluding possible cooperation with other French or European research organizations. Coming as he does from the CNRS [National Scientific Research Center], where he has been his entire career, and having worked with the Americans and been directly involved in the CNES [National Center for Space Studies] scientific programs, he is taking part in the development of future earth observation systems via forthcoming turn-of-the-century French, European, and American satellites.

#### **Italian Firm Invests 24.5 Billion Francs in Environmental R&D**

92WS0261B Paris LE MONDE in French 27 Dec 91 p 20

[Unattributed article: "Ferruzzi-Montedison Invests 24.5 Billion Francs [Fr] to Protect the Environment"]

[Text] The Italian group Ferruzzi-Montedison (agrifood, chemistry), has signed an environmental-protection agreement with the Italian government, under which the group will invest 5,470 billion lire (Fr24.5 billion) during the period 1991-1996. The investment program—covering pollution-control facilities as well as the development of new technologies and the creation of new research centers—will eventually generate sales of Fr13.5 billion.

#### **Germany: Extrusion Technique Aids Plastic Recycling**

92WS0267B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 17 Dec 91 p 8

[Article by "sel": "Breakdown of Plastics Via Extrusion; Fragments Can Be Processed into New Raw Material"]

[Text] Certain composite plastic wastes can be reprocessed via chemical processes. The first step is to break down the plastics, which are hydrocarbon polymers, into fragments of low molecular weight. During subsequent synthesizing processes, the fragments are converted into hydrocarbons having the same value as "new" hydrocarbons. The breakdown of the plastics into usable fragments can be accomplished via degradative extrusion. This was announced by Professor Walter Michaeli of the Institute for Plastics Processing at the Technical College of Aachen.

At this institute, recycling concepts were developed which combined degradative extrusion with known petrochemical processes. With the help of degradative extrusion, plastic wastes can be processed into reusable waxes, oils, or even gases. High thermal and mechanical energy is utilized during the extrusion process to accomplish this. At the same time, reagents that promote breakdown can be added in metered increments to the extruder. Breakdown products can also be removed from the extruder as desired.

One example of these reprocessing techniques is the production of synthesis gas from plastic wastes. During the extrusion process, the plastics are broken down into an oil-like melt which is then gradually forced under high pressure into the gasification reactor. In the reactor, the polymers are converted into synthesis gas via reaction with pure oxygen and water vapor. After it is purified, the synthesis gas can be used for the production of new hydrocarbons.

#### **International Conference Adopts European Energy Charter**

92WS0269A Brussels EUROPE (Documents Supplement) in English 21 Dec 91 pp 1-8

[Article: "Text of the European Energy Charter"; first two paragraphs are EUROPE introduction]

[Text] We are reproducing the text of the "closing document" of the Conference of The Hague in which the European Energy Charter was adopted. EUROPE recalls that the initiative for such a Charter came from the Dutch Prime Minister, Mr. Lubbers and that the project was taken up by the President of the European Commission, Jacques Delors. The Commission drew up a draft project for the Charter, under the responsibility of Mr. Cardoso e Cunha, European Commissioner for Energy. The international Conference was organised by the Netherlands, coordination and the secretariat having been handed over to the European Commission. The technical work took place in Brussels, under the chairmanship of Ambassador Rutten, and the Charter was adopted on 17 December in The Hague. Work must now continue in order to put the finishing touches to a "basic agreement" (which, with binding provisions, will make concrete the principles enshrined in the Charter) and the protocols.

The closing document contains the Charter's text in full.

#### **The Closing Document of the Conference of The Hague on the European Energy Charter**

The representatives of Albania, Armenia, Australia, Austria, Azerbaijan, Belgium, Belorussia, Bulgaria, Canada, Czechoslovakia, Cyprus, Denmark, Estonia, The European Communities, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, The Interstate Economic Committee, Ireland, Italy, Japan, Kazakhstan, Kirghizstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldavia, The Netherlands, Norway, Poland, Portugal, Romania, The Russian Federation, Spain, Sweden, Switzerland, Tadjikistan, Turkey, Turkmenistan, Ukraine, The United Kingdom of Great Britain and Northern Ireland, The United States of America, Uzbekistan, Yugoslavia convened in The Hague, the Netherlands, from 16 to 17 December 1991 in order to adopt the European Energy Charter.

The Conference was opened and closed by the Minister of Economic Affairs of the Netherlands.

Her Majesty, Queen Beatrix of the Netherlands, attended the opening of the Conference.

The Prime Minister of the Netherlands and the Commissioner for Energy of the European Commission addressed the Conference.

During the Conference, contributions were received and statements made by delegates of the signatories.

Determined to give full effect to the results of the Conference, the representatives of the signatories adopted the following text for the European Energy Charter:

#### **European Energy Charter**

The representatives of the signatories meeting in The Hague on 16 and 17 December 1991,

Having regard to the Charter of Paris for a New Europe, signed in Paris on 21 November 1990 at the summit meeting of the Conference on Security and Cooperation in Europe (CSCE);

Having regard to the document adopted in Bonn on 11 April 1990 by the CSCE Conference on Economic Cooperation in Europe;

Having regard to the declaration of the London Economic Summit adopted on 17 July 1991;

Having regard to the report on the conclusions and recommendations of the CSCE meeting in Sofia on 3 November 1989, on the protection of the environment, as well as its follow-up;

Having regard to the agreement establishing the European Bank for Reconstruction and Development signed in Paris on 29 May 1990;

Anxious to give formal expression to this new desire for a European-wide and global cooperation based on mutual respect and confidence;

Resolved to promote a new model for energy cooperation in the long term in Europe and globally within the framework of a market economy and based on mutual assistance and the principle of non-discrimination;

Aware that account must be taken of the problems of reconstruction and restructuring in the countries of central and eastern Europe and in the USSR and that it is desirable for the signatories to participate in joint efforts aimed at facilitating and promoting market-oriented reforms and modernisation of energy sectors in these countries;

Certain that taking advantage of the complementary features of energy sectors within Europe will benefit the world economy;

Persuaded that broader energy cooperation among signatories is essential for economic progress and more generally for social development and a better quality of life;

Convinced of the signatories' common interest in problems of energy supply, safety of industrial plants, particularly nuclear facilities, and environmental protection;

Willing to do more to attain the objectives of security of supply and efficient management and use of resources, and to utilize fully the potential for environmental improvement, in moving towards sustainable development;

Convinced of the essential importance of efficient energy systems in the production, conversion, transport, distribution and use of energy for security of supply and for the protection of the environment;

Recognizing State sovereignty and sovereign rights over energy resources;

Assured of support from the European Community, particularly through completion of its internal energy market;

Aware of the obligations under major relevant multilateral agreements, of the wide range of international energy cooperation, and of the extensive activities by existing international organizations in the energy field and willing to take full advantage of the expertise of these organizations in furthering the objectives of the Charter;

Recognizing the role of entrepreneurs, operating within a transparent and equitable legal framework, in promoting cooperation under the Charter;

Determined to establish closer, mutually beneficial commercial relations and promote energy investments;

Convinced of the importance of promoting free movement of energy products and of developing an efficient international energy infrastructure in order to facilitate the development of market-based trade in energy;

Aware of the need to promote technological co-operation among signatories;

Affirming that the energy policies of signatories are linked by interests common to all their countries and that they should be implemented in accordance with the principles set out below:

Affirming, finally, their desire to take the consequent action and apply the principles set out below:

**Have Adopted the Following Declaration Constituting the "European Energy Charter"**

#### **Title I: Objectives**

The signatories are desirous of improving security of energy supply and of maximising the efficiency of production, conversion, transport, distribution and use of energy, to enhance safety and to minimise environmental problems, on an acceptable economic basis.

Within the framework of State sovereignty and sovereign rights over energy resources and in a spirit of political and economic cooperation, they undertake to promote the development of an efficient energy market throughout Europe, and a better functioning global market, in both cases based on the principle of non-discrimination and on market-oriented price formation, taking due account of environmental concerns. They are determined to create a climate favourable to the operation of enterprises and to the flow of investments and technologies by implementing market principles in the field of energy.

To this end, and in accordance with these principles, they will take action in the following fields:

1. Development of trade in energy, consistent with major relevant multilateral agreements such as GATT, its

related instruments, and nuclear non-proliferation obligations and undertakings, which will be achieved by means of:

- an open and competitive market for energy products, materials, equipment and services;
- access to energy resources, and exploration and development thereof on a commercial basis;
- access to local and international markets;
- removal of technical, administrative and other barriers to trade in energy and associated equipment, technologies and energy-related services;
- modernization, renewal and rationalization by industry of services and installations for the production, conversion, transport, distribution and use of energy;
- promoting the development and interconnection of energy transport infrastructure;
- promoting best possible access to capital, particularly through appropriate existing financial institutions;
- facilitating access to transport infrastructure, for international transit purposes in accordance with the objectives of the Charter expressed in the first paragraph of this Title;
- access on commercial terms to technologies for the exploration, development and use of energy resources.

2. Cooperation in the energy field, which will entail:

- coordination of energy policies, as necessary for promoting the objectives of the Charter;
- mutual access to technical and economic data, consistent with proprietary rights;
- formulation of stable and transparent legal frameworks creating conditions for the development of energy resources;
- co-ordination and, where appropriate, harmonization of safety principles and guidelines for energy products and their transport, as well as for energy installations, at a high level;
- facilitating the exchange of technology information and know-how in the energy and environment fields, including training activities;
- research, technological development and demonstration projects.

3. Energy efficiency and environmental protection, which will imply:

- creating mechanisms and conditions for using energy as economically and efficiently as possible, including, as appropriate, regulatory and market-based instruments;

—promotion of an energy mix designed to minimise negative environmental consequences in a cost-effective way through:

(i) market-oriented energy prices which more fully reflect environmental costs and benefits;

(ii) efficient and coordinated policy measures related to energy;

(iii) use of new and renewable energies and clean technologies;

—achieving and maintaining a high level of nuclear safety and ensuring effective co-operation in this field.

## Title II: Implementation

In order to attain the objectives set out above, the signatories will, within the framework of State sovereignty and sovereign rights over energy resources, take coordinated action to achieve greater coherence of energy policies, which should be based on the principle of non-discrimination and on market-oriented price formation, taking due account of environmental concerns.

They underline that practical steps to define energy policies are necessary in order to intensify cooperation in this sector and further stress the importance of regular exchanges of views on action taken, taking full advantage of the experience of existing international organizations and institutions in this field.

The signatories recognize that commercial forms of cooperation may need to be complemented by intergovernmental cooperation, particularly in the area of energy policy formulation and analysis as well as in areas which are essential and not suitable to private capital funding.

They undertake to pursue the objectives of creating a broader European energy market and enhancing the efficient functioning of the global energy market by joint or coordinated action under the Charter in the following fields:

- access to and development of energy resources;
- access to markets;
- liberalization of trade in energy;
- promotion and protection of investments;
- safety principles and guidelines;
- research, technological development, innovation and dissemination;
- energy efficiency and environmental protection;
- education and training.

In implementing this joint or coordinated action, they undertake to foster private initiative, to make full use of the potential of enterprises, institutions and all available financial sources, and to facilitate cooperation between

such enterprises or institutions from different countries, acting on the basis of market principles.

The signatories will ensure that the international rules on the protection of industrial, commercial and intellectual property are respected.

### 1. Access to and development of energy resources

Considering that efficient development of energy resources is a sine qua non for attaining the objectives of the charter, the signatories undertake to facilitate access to and development of resources by the interested operators.

To this end, they will ensure that rules on the exploration, development and acquisition of resources are publicly available and transparent; they recognize the need to formulate such rules wherever this has not yet been done and to take all necessary measures to coordinate their actions in this area.

With a view to facilitating the development and diversification of resources, the signatories undertake to avoid imposing discriminatory rules on operators, notably rules governing the ownership of resources, internal operation of companies and taxation.

### 2. Access to Markets

The signatories will strongly promote access to local and international markets for energy products for the implementation of the objectives of the Charter. Such access to markets should take account of the need to facilitate the operation of market forces, and promote competition.

### 3. Liberalization of trade in energy

In order to develop and diversify trade in energy, the signatories undertake progressively to remove the barriers to such trade with each other in energy products, equipment and services in a manner consistent with the provisions of GATT, its related instruments, and nuclear non-proliferation obligations and undertakings.

The signatories recognize that transit of energy products through their territories is essential for the liberalization of trade in energy products. Transit should take place in economic and environmentally sound conditions.

They stress the importance of the development of commercial international energy transmission networks and their interconnection, with particular reference to electricity and natural gas and with recognition of the relevance of long-term commercial commitments. To this end, they will ensure the compatibility of technical specifications governing the installation and operation of such network, notably as regards the stability of electricity systems.

### 4. Promotion and protection of investments

In order to promote the international flow of investments, the signatories will, at national level, provide for

a stable, transparent legal framework for foreign investments, in conformity with the relevant international laws and rules on investment and trade.

They affirm that it is important for the signatory States to negotiate and ratify legally binding agreements on promotion and protection of investments which ensure a high level of legal security and enable the use of investment risk guarantee schemes.

Moreover, the signatories will guarantee the right to repatriate profits or other payments relating to an investment and to obtain or use the convertible currency needed.

They also recognize the importance of the avoidance of double taxation to foster private investment.

#### 5. Safety principles and guidelines

Consistent with relevant major multilateral agreements, the signatories will:

- implement safety principles and guidelines, designed to achieve and/or maintain high levels of safety, in particular nuclear safety and the protection of health and the environment;
- develop such common safety principles and guidelines as are appropriate and/or agree to the mutual recognition of their safety principles and guidelines.

#### 6. Research, technological development, innovation and dissemination

The signatories undertake to promote exchanges of technology and cooperation on their technological development and innovation activities in the fields of energy production, conversion, transport, distribution and the efficient and clean use of energy, in a manner consistent with nuclear non-proliferation obligations and undertakings.

To this end, they will encourage cooperative efforts on:

- research and development activities;
- pilot or demonstration projects;
- the application of technological innovations;
- the dissemination and exchange of know-how and information on technologies.

#### 7. Energy efficiency and environmental protection

The signatories agree that cooperation is necessary in the field of efficient use of energy and energy-related environmental protection. This should include:

- ensuring, in a cost-effective manner, consistency between relevant energy policies and environmental agreements and conventions;
- ensuring market-oriented price formation, including a fuller reflection of environmental costs and benefits;

- the use of transparent and equitable market-based instruments designed to achieve energy objectives and reduce environmental problems;

- the creation of framework conditions for the exchange of know-how regarding environmentally sound energy technologies and efficient use of energy;

- the creation of framework conditions for profitable investment in energy efficiency projects.

#### 8. Education and training

The signatories, recognizing industry's role in promoting vocational education and training in the energy field, undertake to cooperate in such activities, including:

- professional education;
- occupational training;
- public information in the energy efficiency field.

#### Title III: Specific Agreements

The signatories undertake to pursue the objectives and principles of the Charter and implement and broaden their cooperation as soon as possible by negotiating in good faith a Basic Agreement and Protocols.

Areas of cooperation could include:

- horizontal and organisational issues;
- energy efficiency, including environmental protection;
- prospecting, production, transportation and use of oil and oil products and modernization of refineries;
- prospecting, production and use of natural gas, interconnection of gas networks and transmission via high-pressure gas pipelines;
- all aspects of the nuclear fuel cycle including improvements in safety in that sector;
- modernization of power stations, interconnection of power, networks and transmission of electricity via high-voltage power lines;
- all aspects of the coal cycle, including clean coal technologies;
- development of renewable energy sources;
- transfers of technology and encouragement of innovation;
- cooperation in dealing with the effects of major accidents, or of other events in the energy sector with transfrontier consequences.

The signatories will, in exceptional cases, consider transitional arrangements. They, in particular, take into account the specific circumstances facing some states of central and eastern Europe and the USSR as well as their need to adapt their economies to the market system, and

accept the possibility of a stage-by-stage transition in those countries for the implementation of those particular provisions of the Charter, Basic Agreement and related Protocols that they are, for objective reasons, unable to implement immediately and in full. Specific arrangements for coming into full compliance with Charter provisions as elaborated in the Basic Agreement and Protocols will be negotiated by each Party requesting transitional status, and progress towards full compliance will be subject to periodic review.

#### Title IV: Final Provision

The signatories request the government of the Netherlands, President-in-Office of the Council of the European Communities, to transmit to the Secretary-General of the United Nations the text of the European Energy Charter which is not eligible for registration under Article 102 of the Charter of the United Nations.

In adopting the European Energy Charter, ministers or their representatives record that the following understanding has been reached:

The representatives of the Signatories understand that in the context of the European Energy Charter, the principle of non-discrimination means Most-Favoured-Nation Treatment as a minimum standard. National Treatment may be agreed to in provisions of the Basic Agreement and/or Protocols.

The original of this Concluding Document, drawn up in English, French, German, Italian, Russian and Spanish texts, will be transmitted to the government of the Kingdom of the Netherlands, which will retain it in its archives. Each of the Signatories will receive from the government of the Kingdom of the Netherlands a true copy of the Concluding Document.

In witness whereof, the representatives of the Signatories, mindful of the high political significance which they attach to the results of the Conference, and declaring their determination to act in accordance with the provisions of the European Energy Charter, have subscribed their signatures below.

#### Environment Commissioner Comments on Audit

92WS0269D Brussels EUROPE in English 21 Dec 91  
p 8

[Article: "(EU) EC/Environment: Statements by Mr. Ripa di Meana on the Eco-Audit. The Seat of the Environmental Agency. Procedures Concerning the United Kingdom—Criticism of the Approach by Industrialists"]

[Text] Brussels, 20 Dec 91 (AGENCE EUROPE)—The European Commissioner charged with environmental affairs, Mr. Ripa di Meana, personally released to the

press the Commission's proposal to the Council concerning the environmental audit (see yesterday's EUROPE, p. 9, and EUROPE of 30 November, p. 11, for the technical aspects).

He underlined the fact that the Commission felt it was necessary to retain for this initiative the form of regulation (compulsory in all its elements for all Member States) in order to avoid competition distortion. If each Member State did, in fact, have the capacity to define the provisions for granting the logo, conditions could be more or less stringent depending on the country and companies could be forced to choose the location where the logo would be obtained more easily. Uniform EEC regulation is therefore indispensable. Mr. Ripa di Meana also pointed out that the small- and medium-sized firms will also find it advantageous to obtain the logo as the benefits (for their image, but not only this) will be concrete and the cost minimum (3,000 ECUs [European Currency Units] every three years, for a site of modest dimensions). If the project is adopted, the Commissioner feels there could be a new philosophy of industrial production as a result. Mr. Ripa di Meana nevertheless spoke harshly as regards industry, which is generous in promises and declarations of principle but, for concrete action, often opposed to operational initiatives. "Unfortunately I have always met with the opposition of powerful lobbies acting even within the Berlaymont, whether it be for the catalytic exhaust pipe, diesel fuel norms, impact studies related to major agricultural projects or, more recently, for the proposal of a tax on CO<sub>2</sub>—and now the eco-audit", he stated.

The Commissioner also gave indications on:

a) The seat of the European Environmental Agency (EEA). Next month Mr. Ripa di Meana will ask the Commission to put the proposal to the Twelve for the Agency to have "the seat in turn" as a temporary solution, each half-year being in the capital of the presiding Council. The seat would therefore be Lisbon for the first half of 1992, London during the second half, and so on. It would no doubt be an "irrational and far from perfect" solution but it would make it possible to overcome the current total deadlock and to concretise the birth of EEA. Failing this, the Community would find itself in a more than embarrassing situation at the Rio Conference in June. With this initiative, the Commission would be reacting to a "cynical refusal" on the part of France and Belgium by allowing the seat to be designated and the EEA to exist. It would be all the better if this initiative could unblock the situation and reach a final decision, which would only be good sense.

b) Infringement proceedings opened against the United Kingdom for non-respect of the EEC 1985 Directive which made "environmental impact studies" compulsory for major public or private works (see EUROPE of 18 October, p. 8). Mr. Ripa di Meana was astonished to have read indications of Mr. Heseltine's response in the British press—long before receiving the letter. The letter has now arrived and will be carefully studied. The

Commissioner cannot make any predictions as to the result of the legal analysis as regards the reasons for which the United Kingdom feels there is no infringement on its part of Community legislation. Nevertheless, he regrets that the British Government has not followed up his "political appeal" to suspend the work in question (which has not been preceded by the preliminary impact study) pending the results of proceedings. EUROPE recalls that these are major projects such as enhancement of the Thames bank, the rail connection between London and the Channel Tunnel, an incinerator for the South Warwick hospital, the Coca-Cola/Schweppes factory in Northampton, etc.

Moreover, Mr. Ripa di Meana confirmed his intention of submitting to the Commission, in January 1992, a project for the fifth EEC programme for the environment, which will be valid for ten years and will be "revolutionary" to a certain extent. He hopes the Commission will submit it to the Council in the first half of the year, under the Portuguese presidency, and that the Council approve it in the second half, under the British presidency. The main guidelines have already been defined by the Commission's services, but there remain some fundamental policy options, for example, whether it is possible to envisage the creation of a Community corp of inspectors for the environment.

#### **EC to Finance THERMIE Clean Electricity Production Technology Project**

92WS0269H Brussels EUROPE in English 6 Dec 91  
p 10

[Article: "(EU) EC/Energy: The European Commission Announces It Will Finance Technology for Electricity Production That Reduces CO<sub>2</sub> Emissions by 20%. Within the Framework of the THERMIE Programme"]

[Text] Brussels, 5 Dec 91 (AGENCE EUROPE)—The European Commission announces that it has decided to finance a project for the development of electricity production technology able to reduce CO<sub>2</sub> emissions by 20 percent as compared with traditional coal power plants.

Financing comes under the THERMIE programme (European technologies for energy management) and concerns the design, construction and demonstration of an electricity production unit fuelled by gasified coal through the idea of combined cycles (IGCC—Integrated Gasification Combined Cycle). The project will be developed in collaboration with six EC electricity enterprises. It will benefit from a first tranche of 15 MECUs, from Community financing.

IGCC technology is currently considered as representing future electricity production from coal, as it makes it possible to drastically reduce polluting CO<sub>2</sub> emissions as well as sulphur dioxide and nitrogen oxide. Also, to the Council's request (THERMIE regulation) to organise European cooperation around a major transnational project using this technology, the Commission has taken

this decision which is the first concerning a "targeted" project in the framework of the "THERMIE" programme.

The project will be implemented by four Spanish electricity companies (ENDESA, Hidroelectrica Espanola, Sevillana de Electricidade, Hidroelectrica del Cantabrico), by Electricite de France and Electricidade de Portugal, on the Puertollano site in the centre-south of Spain. Other electricity companies have already informed the Commission that they wish to join in this first Community attempt at collaboration in thermoelectric production.

During the demonstration period, a large range of coals (EC and international) will be tested. After this period, the IGCC power plant will operate with bituminous coal produced in the open-skies mine in Puertollano. Emissions of SO<sub>2</sub> (sulphur dioxide) and NO<sub>x</sub> (nitrogen oxide) will be, respectively, 40 and 11 times less than limits laid down in the Community directive on emissions from electricity power plants.

#### **European Car Recycling Concept Launched**

92WS0269I Brussels EUROPE in English 18 Dec 91  
p 16

[Article: "(EU) EC/Environment: European Automobile Industry Initiates European Car Recycling Concept"]

[Text] Brussels, 17 Dec 91 (AGENCE EUROPE)—The ACEA, the Association of European Automobile Manufacturers, has initiated a European car recycling concept in order to minimise any adverse environmental impact from the disposal of cars at the end of their useful life. The ACEA presents the concept below in the form of a commitment:

- 1) The European automobile industry accepts its responsibilities regarding the management of vehicle disposal. It shares some of these responsibilities with the vehicle owner.
- 2) The appropriate supplying industries concerned share responsibility for the processing or recycling of their products.
- 3) Automobile manufacturers are already taking major steps to avoid and reduce residual material (by modifying vehicle design specifications) to reduce the variety of materials used and increase the possibility for the reprocessing and recycling of components and materials.
- 4) National authorities should promote the operation of processing facilities, meeting European regulations to deal with remaining shredder residues.
- 5) The introduction of a mandatory "Certificate of Disposal" is needed, which the last vehicle owner has to obtain before he can dispose of his vehicle and be relieved from tax/insurance obligations. The "Certificate of Disposal" would be issued by an authorised qualified operator. This procedure would ensure the avoidance of

uncontrolled dumping of the unwanted vehicle; that only qualified operators fulfilling existing or future legal requirements would collect, dismantle, sort and process vehicles for disposal; and the granting of motor vehicle industry technical assistance to qualified operators. There is a need for a widespread, flexible network of qualified operators in Europe. Only competent operators should become authorised to process vehicles for disposal. The proposed concept is strictly market-orientated. The qualified operator should operate according to market prices. In the future, this may result in a payment to a vehicle owner at the moment of disposal due to the intrinsic value of the material. The more "recyclable" a vehicle is, the higher the value may be. For incomplete vehicles or vehicles difficult to recycle, the owner may have to pay for disposal. This is viewed as an encouragement for automobile manufacturers to work harder to design easy-to-recycle automobiles as well as to establish recycling chains.

#### **European Car Manufacturers to Reduce CO<sub>2</sub> Emissions**

*92WS0269J Brussels EUROPE in English 13 Dec 91 p 15*

[Article: "(EU) Environment: European Automobile Manufacturers Volunteer To Reduce CO<sub>2</sub> Emissions by 10% by 2005"]

[Text] Brussels, 12 Dec 91 (AGENCE EUROPE)—European passenger car manufacturers grouped in ACEA, Association des constructeurs europeens d'automobiles, the newly established manufactures' association, have volunteered to reduce CO<sub>2</sub> emissions of their cars by 10 percent within the period 1993 to 2005, thereby bringing their support to the objective the EC has set itself of stabilising these emissions at their 1990 level. The ACEA recalls that total road transport's contribution to man-made CO<sub>2</sub> emissions is less than 14

percent worldwide and 19 percent in the EC (15 percent for passenger cars). Moreover, according to the Association, the manufacturers have managed to reduce average fuel consumption by more than 20 percent since 1978. They note that improvements can still be achieved if other methods are adopted in other fields relating to road traffic, such as: a) traffic management; b) development of alternative fuels and c) adapting appropriate driving methods.

According to the ACEA, this commitment should be supplemented by a new, global and integrated European approach to reduce CO<sub>2</sub> emissions, which should be part of a balanced worldwide programme directed at sources of CO<sub>2</sub>/greenhouse gases. If a carbon tax on energy is part of this programme, the automobile industry emphasises the need to offset this additional burden on the automobile consumer by a reduction of the heavy taxes paid when buying or using automobile products. Should such measures affect the European industry exclusively, ACEA stresses that this would create a competitive disadvantage vis-a-vis other industrial regions which are not prepared to take similar steps, notably North America and Japan.

#### **German University Funds Examination of ERS-1 Data**

*Duesseldorf VDI NACHRICHTEN in German 06 Dec 91 p 18*

[Text] Radar Maps: Around 1 million German marks are available to the geoscientific institutes of Ludwig-Maximilian University in Munich for studies with data from the ERS-1 European satellite. The extensive project has now been approved by the Federal Ministry for Research and Technology (BMFT) within the framework of the OEA (Oceans, Ice, and Atmosphere) scientific project. In addition, 13 states are participating in the ERS-1 plan with their own projects.